

**INTERREGIONAL “LANDSCAPES OF MOVEMENT” AND THE LA UNIÓN
ARCHAEOLOGICAL DISTRICT OF NORTHEASTERN COSTA RICA**

By

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**INTERREGIONAL “LANDSCAPES OF MOVEMENT” AND THE LA UNIÓN
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ABSTRACT

In Costa Rica and the Circum-Caribbean, identifying the locations, functions, and evolution of past networks of human movement contributes to understanding pre-Hispanic interregional interactions and exchanges. I hypothesize the existence of Period VI (A.D. 1000 – 1550) routes of interdistrict movement between the northeastern Caribbean Lowlands and the Central Highlands of Costa Rica. To test this hypothesis, I use a multiple-method approach: archival research of historic roads and paths, archaeological reconnaissance of late pre-Hispanic features, and geographic information systems (GIS) least cost path (LCP) and least cost corridor (LCC) analyses. I discuss the possible functions and evaluate the roles of these routes among other interconnected networks. While archaeologists have documented some pre-Hispanic roads and paths in Costa Rica, few pre-Hispanic interregional routes of human movement have been identified. During the Colonial Period, the Spanish utilized these same *landscapes of movement* and *waterscapes of movement* for their own transportation and communication. Since the use of some routes persist into the present, archival research can reveal routes of pre-Hispanic movement. The results of my investigations show that there is a relationship between the optimal (GIS modeled) and historical landscapes of movement with the archaeological evidence that such a route existed during the late pre-Hispanic. While a regional archaeological survey is required to identify the late pre-Hispanic *network of movement*, my multiple-method approach identifies segments of that network and examines how humans moved across the landscape of northwestern Costa Rica over one thousand years ago.

Key words: Costa Rica, archaeology, Circum-Caribbean, pre-Hispanic Era, Cartago Phase, La Cabaña Phase, Caribbean Lowlands, Central Highlands, human movement, landscapes of movement, waterscapes of movement, Nuevo Corinto (L-72 NC), Las Flores (L-143 LF)

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CHAPTER 1: INTRODUCTION

Between A.D. 1000 and A.D. 1550, the settlement of Nuevo Corinto (L-72 NC) and its neighboring towns in the La Unión District¹ were part of a bustling community of farmers, merchants, and craftsmen. Located to the northeast of the Cordillera Central of Costa Rica and between the confluences of the Corinto River with the Chirripó River on the Caribbean Lowlands, these people lived on fertile land for both agriculture and commerce (see Figure 1 for location). Now all that remains of this community are their ruins: the stone foundations of buildings, broken or discarded tools, sherds of ceramic vessels, and other durable evidence that has survived the centuries covered in sediment shrouded in vegetation. These remains are of a people who were constantly on the move, and the types and varieties of artifacts recovered from scientific excavations at Nuevo Corinto confirm their participation in extensive networks of trade and exchange with neighbors near and far. Portions of this network remain visible as roads and paths, now covered in centuries of sediment, that radiate outward from the heart of the Nuevo Corinto to the northeast, east, and southwest.

These long forgotten roads were part of a *network of movement* that once connected the people of Nuevo Corinto to surrounding settlements and cemeteries, as well as to natural and cultural resources procured from local and distant lands. This network consisted of all of the roads, trails, and paths, or *landscapes of movement* (Snead et al. 2009a) and the *waterscapes of movement*, the bodies of water navigated by members of a society, utilized by the population for all of their transportation and communication purposes. Using historic, geographic, and archaeological evidence, I hypothesize and test the existence of an interregional landscape of

¹ I use this archaeological district to look beyond the isolated sites to see the larger cultural patterns of the community Nuevo Corinto was a part of in pre-Hispanic times. I explain this in greater detail in chapter 3.

movement that would have once connected Nuevo Corinto to the peoples inhabiting the Central Highlands. The aim of my research is to describe the network of movement late pre-Hispanic inhabitants of Nuevo Corinto used to interact and exchange with distant populations in the Central Highlands. This thesis provides an example of how researchers interested in past human movement might discern landscapes and waterscapes of movement among any number of sites and geographic regions using a multifaceted methodological approach.



Figure 1. Nuevo Corinto is located to the northeast of the Cordillera Central near the center of the Central Region of the Isthmo-Colombian Area.

The Archaeology of Roads, Trails, and Paths

Despite the fact that roads, trails, and paths are among the most common features of the human landscape, providing significant information about the structure of a society, substantive anthropological literature on these features has only recently emerged over the past four decades (Snead et al. 2009b:1-2). This may be because they are considered to be part of “off site” archaeology (Foley 1981). Since the 1980s, the study of human landscapes of movement has advanced significantly, moving from its documentary and typological past toward research that contributes to broader discussions of past and present inter- and intrasocietal human interactions by examining the route networks. The most robust literature on roads, trails, and paths in prehistory discusses formalized road networks in “complex” societies such as the Inkas (Bauer 1992; Coella Rodríguez 2000; Hyslop 1984, 1991; Kendall 2000; Kosok 1954; Lippi 2000; McGovern 1927), Wari (Schreiber 1991), Teotihuacános (Charlton 1991), Aztecs (Santley 1991), Maya (Benavides Castillo 1981; Bolles and Folan 2001; Chase and Chase 2001; Cobos and Winemiller 2001; Díaz Bolio 1992; Folan 1991; Folan et al. 2001; Folan et al. 1995; Fowler 2001; Keller 2009; Mock 1997; Normark 2008; Schwake 2000; Shaw 2001; Stanton 2005; Villa Rojas 1934), Romans (Ben-David 2002; Chevallier 1976; Davies 2008; Fischer et al. 1996; French 1981a, b; Isaac and Roll 1982; Johnston 1979; Kahane et al. 1968; Laurence 1999; Margary 1955; Sitwell 1981; Staccioli 2003; Vanhove et al. 1996), Persians (French 1998; Graf 1994), Mycenaean (Jansen 1994, 2002), and Chacoans (Mathien 1991; Obenauf 1991; Sever 1990; Sever and Wagner 1991; Sofaer et al. 1989; Windes 1991), among others. These studies have shown that formalized roads represent the “skeletal” structures of economic, political, religious, and/or social ties and that examining the linkages within these features reveals their particular functions (Hassig 1991:18). Landscapes of movement unite friendly neighbors,

facilitate trade, and give access to a variety of resources. They can also reveal the existence of hostile territories and the choices that travelers made to avoid either direct or indirect conflict.

In the anthropological literature on roads, trails, and paths, several significant single-author books and edited volumes make substantial contributions. The first major contribution to the study of roads, trails, and paths was Trombold's (1991a) edited volume *Ancient Road Networks and Settlement Hierarchies in the New World*, which contains articles describing methods for identifying, dating, and determining the functions of roads throughout the Americas. For the first time, articles on indigenous road networks were brought together for comparative analyses. The next significant work was the volume *Caminos precolombinos* edited by Cardale de Schrimpf and Herrera (2000), which mainly focused on road and trail networks in the Northern Andes but included a few other articles about past indigenous roads elsewhere as well. Most recently, Snead, Erickson, and Darling's (2009a) edited volume *Landscapes of Movement* analyzes these features from an anthropological perspective. Its articles synthesize and define the broad objectives and potential methodologies of research on human landscapes of movement. Other books and articles that contain analyses of regional road networks include Hyslop's (1984) *The Inka Road System*, Shaw's (2008) *The White Roads of the Yucatán*, and Gibson's (2007) "The Archaeology of Movement in a Mediterranean Landscape." These works make up a seminal body of literature on landscapes of movement upon which I will base my own investigations in road, trail, and path networks in the Central (Archaeological) Region of Costa Rica.

The Archaeology of Landscapes of Movement in Costa Rica

Landscapes and waterscapes of movement facilitated the distribution of people and the movement of goods and information among populations throughout most, if not all, of human

history. In Costa Rica, there is some evidence for continuity of the network of movement across time. For example, Castro Solera (2007) determined that a pre-Hispanic route likely ran parallel to an historic mule trail and concluded that pre-Hispanic paths were likely reutilized by subsequent populations. In his study, Castro Solera attempted to use settlement patterns and geographic data to predict the locations of pre-Hispanic footpaths between the archaeological sites of Paso Real and Cañas Gordas in South Pacific Costa Rica. While populations continued to use some routes through the Colonial Period and into the present, they abandoned other landscapes of movement. Eventually, accretion, erosion, or other natural processes (e.g., bioturbation, landslides, the shifting of river courses due to floods, volcanic activity, etc.) made those abandoned terrestrial routes virtually invisible. Given that landscapes are by nature palimpsests (Bailey 2007), abandoned landscapes of movement are not easy to identify, especially when comprised of informal paths and trails, the status quo before the modern industrialized era.

Before the arrival of the Spanish, the Caribbean Lowlands of Costa Rica were inhabited by a number of powerful chiefdoms (Fonseca Zamora 1992; Ibarra Rojas 2002) or complex tribes (Habicht-Mauche et al. 1987; Hoopes 1988) that built cobblestone roads and utilized footpaths connecting peripheral sites to important centers. Archaeological research in Costa Rica has revealed the existence of some of these impressive formalized intersite landscapes of movement associated with architectonically complex sites such as Las Mercedes (Vázquez Leiva 2006b; Vázquez Leiva and Chapdelaine 2008), Monumento Nacional Guayabo (Arce 2005; Vázquez Leiva et al. 2002), Cutrís (Sever and Sheets 2007; Sheets 2009; Vázquez Leiva et al. 2003), Agua Caliente (Peytrequín Gómez 2009), and others (Troyo Vargas and Guerrero Miranda 1998) (see Figure 2). Formalized routes, such as these, are the exception and are only a

few of many landscapes of movement that these people used. The majority of routes were footpaths between sites and cemeteries, such as those documented by the Arenal project directed by Payson Sheets (Butler 2005; McKee and Sever 1994; McKee et al. 1994; Sever and Sheets 2007; Sever et al. 2003; Sheets 2009; Sheets and Sever 1991). However, the preservation conditions of these earlier eroded footpaths within layers of volcanic ash near Arenal might also be the exception. In such a physically dynamic landscape as Costa Rica, processes such as high rainfall, volcanism, heavy bioturbation, and tectonic movement contribute to significant and rapid changes.

While the preservation conditions of pre-Hispanic trails and paths are not ideal, historians have studied some colonial road networks that may have been based on preexisting indigenous trails (Molina Montes de Oca 2005; Solorzano Fonseca 1988), and might be used to identify parts of the pre-Hispanic network of movement. Such historical research indicates that during the Colonial Period, early European colonists and explorers discovered and used some of the interregional indigenous roads and footpaths that crisscrossed the Costa Rican landscape. This connection between historic and pre-Hispanic routes is best illustrated by Castro Solera's (2007) work in the Diquís Delta Region of Costa Rica. Furthermore, this connection is suggested by the rapidity with which foreign Spanish invaders were able to travel across the dynamic isthmian landscape (e.g., Vázquez de Coronado 1964). Identifying historical landscapes of movement with possible pre-Hispanic antecedents can assist in the search for these features in an area where changes in cultural systems, land-use, and reforestation processes have made the observation of past landscapes of movement difficult, even by remote sensing.

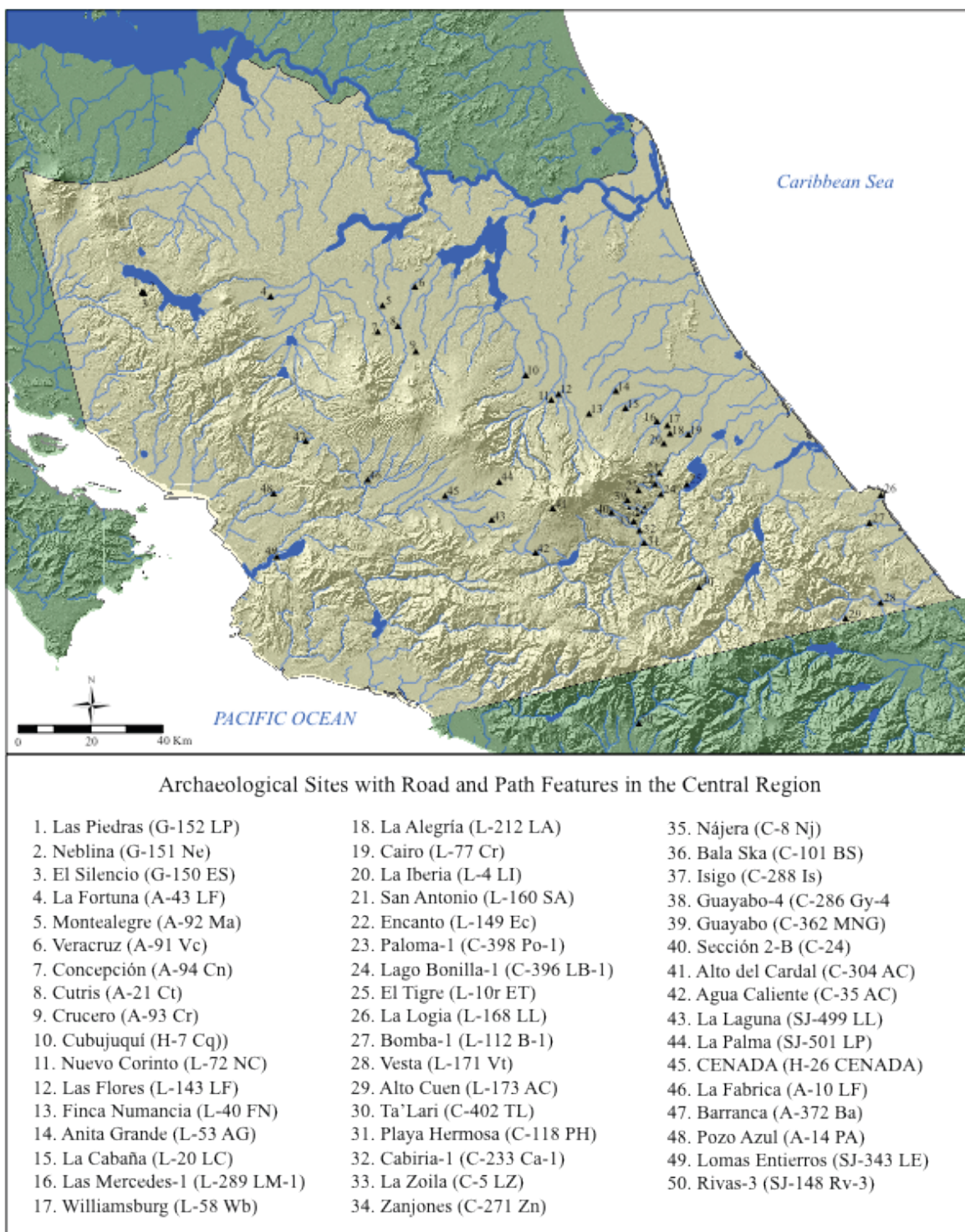


Figure 2. There are many archaeological sites with road and path features in the Central Region (Departamento de Antropología e Historia del Museo Nacional de Costa Rica (DAH-MNCR) 2012; Troyo Vargas and Guerrero Miranda 1998; Vázquez Leiva 2006b).

While landscapes and waterscapes of movement extend beyond the blurry boundaries of large-scale systems, they are mostly concentrated within and between the cores and peripheries of these self-contained worlds or mini-systems.² The human landscape of the Central American isthmus has been constantly changing since humans became a part of its ecosystem, resulting in a palimpsest of information with voids caused by erosion and other geologic processes. Since footpath preservation is poor in most tropical environments, such as Costa Rica, a comprehensive road map of the past is not a feasible objective. Thus, the full extent of inter- and intra-connectivity within the area will remain known. Nevertheless, any and all pre-Hispanic road maps we can produce will enhance our understanding of past social, economic, religious, and political relations among Central American populations and how those relations changed over time. Identifying past networks of movement, their evolution through time, and their functions are important steps toward understanding the dynamics of the pre-Hispanic Circum-Caribbean World-System.³

² The terms “core,” “periphery,” “world,” and “mini-systems” have specific meanings in Wallerstein’s World-Systems Theory terminology.

³ I will define the Circum-Caribbean World-System in the coming pages.



Figure 3. Located in north central Costa Rica, my study area includes most of the Cordillera Central and the San Carlos Plains.

Objectives and Hypotheses

The objective of this study is to situate the local landscapes and waterscapes of movement of the La Unión District within the larger network of movement, the network of interregional interaction and exchange. To begin this process, analyses are limited to the interregional communications among the populations of the La Union District on the Caribbean

Lowlands and archaeological districts of the Central Highlands⁴ of Costa Rica. Since the indigenous populations might have used a number of natural passes to communicate and trade through the Cordillera Central, I needed a large enough study area not to bias the possibilities. My study area is about 5965 km², consisting of much of the Línea Vieja Subregion,⁵ the Cordillera Central, and the Central Highlands Subregion (see Figure 3). My temporal focus spans from Period VI (A.D. 1000 – 1550) of the pre-Hispanic Era to the Liberal Period (A.D. 1858 – 1921), with a principal focus on the former. I use data collected from recent investigations at Nuevo Corinto (Aguilar Bonilla and Peytrequín Gómez 2003; Hoopes et al. 2009) and the rest of La Unión (Achio Fuentes 2000; Acuña Marín et al. 2005; Novoa Espinoza 1999; Vázquez Leiva 2006a) in conjunction with historic documents and archaeological publications to explore past interdistrict and interregional interaction via the routes along which such interactions took place.

Reconstructing the entirety of any network of movement may not be possible, but archaeological and ethnohistoric records can help identify where roads and other routes of travel once were and may be—albeit partially—preserved. While archaeological documentation of segments of formalized pre-Hispanic roads is common in the Caribbean Lowlands and much is known about Colonial Period roads and mule trails in Costa Rica, little attempt has been made to study the relationships among neighboring archaeological sites in the Isthmo-Colombian Area using the analysis of roads and trails in conjunction with bodies of navigable water. All of the

⁴ I do not define the districts of the Central Highlands within my thesis, because such definitions will require detailed settlement pattern analyses of all registered archaeological sites within the subregion.

⁵ Since the middle of the 20th century, archaeologists have mentioned some subregions of the Central Region. Most common of these, the Línea Vieja Subregion is named after the historic landscape of movement called the *Línea Vieja*, or “Old Line,” railroad that extended from the town of Carrillo (previously known as Río Sucio) to Puerto Limon during the late 1800s (Stewart 1964). This subregion contains many important pre-Hispanic archaeological sites.

economic, social, political, and ritual activities of this society would have taken place within this larger network of movement.

Three important elements of this network would have been: 1) connections among communities in the Caribbean Lowlands with population centers in the Central Highlands, 2) connections among communities in other parts of Costa Rica with population centers in the Caribbean Lowlands, and 3) connections among communities in the Caribbean Lowlands and the Central Highlands with populations in the Caribbean Sea and its surrounding areas. The first may have been associated with a posited pre-Hispanic Carrillo Road of the La Palma Depression. The second may have been associated with pre-Hispanic connections along the route where Minor Cooper Keith built the historic Línea Vieja railway in the late 19th Century. The third may have utilized navigable portions of the Chirripó River and the region of “Desaguadero,” the mouth of the San Juan River. This thesis will evaluate the archaeological and historic evidence for all three of these, with a principal focus on the first two.

The hypotheses I will test depend on several conditions or premises: (1) that extensive interaction and exchange occurred among the late pre-Hispanic populations of the Caribbean Lowlands and those of the Central Highlands; (2) that the La Unión District, which includes Nuevo Corinto, was part of the larger Línea Vieja Subregion; and (3) that the observed landscapes of movement, radiating outward from Nuevo Corinto, are part of an interdistrict network of movement.

Null Hypothesis 1: There is no significant difference in the location between the known Liberal Period landscape(s) of movement (e.g., Carrillo Road) and the landscape(s) of movement used by the late pre-Hispanic inhabitants to cross the Cordillera Central.

Alternative Hypothesis 1: There is a significant difference in the location between the known Liberal Period landscape(s) of movement and the landscape(s) of movement used by the late pre-Hispanic inhabitants to cross the Cordillera Central.

Based on historic examples, I hypothesize possible routes that might have been used during the late pre-Hispanic Period (routes dating to Period VI [A.D. 1000-1550]) and then propose a methodology for testing these possibilities and exploring their past functions and properties. I propose that a direct historical approach (Steward 1942; Strong 1972; Wedel 1938) or *upstreaming* approach (Fenton 1949, 1952) to pre-Hispanic landscapes and waterscapes of movement—one that begins with the examination of historic routes and proceeds backward into the archaeological record—can reveal possible routes that might have been used during the pre-Hispanic Era based on historic examples.

Null Hypothesis 2: A world-systems analysis of the known segments of the network of movement extending across the northeastern Caribbean Lowlands and beyond is useful for elucidating the socio-cultural functions of the late pre-Hispanic network of movement.

Alternative Hypothesis 2: A world-systems analysis of the known segments of the network of movement extending across the northeastern Caribbean Lowlands and beyond is not useful for elucidating the socio-cultural functions of the late pre-Hispanic network of movement.

Null Hypothesis 3: Using world-systems terminology, the Línea Vieja Subregion was a late pre-Hispanic core in the northeastern Caribbean Lowlands of Costa Rica and part of a Circum-Caribbean World-System.

Alternative Hypothesis 3: Using world-systems terminology, the Línea Vieja Subregion was not a late pre-Hispanic core in the northeastern Caribbean Lowlands of Costa Rica and part of a Circum-Caribbean World-System.

World-systems theory was developed in the late 1960s and early 1970s by sociologists Frank (1967) and Wallerstein (1974) to explain world history and macro-social change according to an intersocietal division of labor (consisting of core, periphery, and semi-periphery subunits) that structures the world-economic spheres of influence. Wallerstein (1974) used world-systems theory to explain the development of the modern highly interconnected global capitalistic society from the perspective of the Mediterranean Sea and surrounding territories. Sociologists and archaeologists have since modified this theory to examine the nature, processes, and structures of intersocietal contexts of pre-capitalistic social change (Chase-Dunn and Hall 1993; Chase-Dunn and Hall 1991; Hall et al. 2011; Kardulias 1999; Kardulias and Hall 2008; Peregrine and Feinman 1996).

I conduct a world-systems analysis, an analysis using world-systems concepts (c.f., Wallerstein 1974), of Nuevo Corinto with respect to the Central Region and the rest of the Circum-Caribbean world. The Circum-Caribbean World-System is a macro-spatial scale of inference based in theoretical concepts originally developed by Wallerstein (1974) and conforming to the results of recent research recognizing cultural similarities among the pre-Hispanic populations of the Caribbean coastlines of Central America and northern South

America and the Caribbean islands (Rodríguez Ramos and Pagán Jiménez 2006). World-systems theory (c.f., Wallerstein 1974) provides a framework to describe the real interdistrict interactions that took place in pre-Hispanic times and necessitated the landscapes of movement. Ultimately, my goal is to situate past human activity within the waterscapes and landscapes of movement of a larger network in order to formulate models for the interdistrict and intradistrict interaction of Nuevo Corinto within a Circum-Caribbean World-System. This world-system is one that incorporates the peoples inhabiting the lands surrounding the Caribbean Sea, including those of the Isthmo-Colombian Area, Caribbean Area, and (parts if not all of the) Mesoamerican Area, into one macro-spatial unit that permits the interpretation of these populations as participating in large networks of interaction and exchange.

Due to the growing understanding of the interaction spheres that existed among mainland and the Antillean populations (Rodríguez Ramos 2010; Rodríguez Ramos and Pagán Jiménez 2006), I propose that a world-systems model (c.f., Wallerstein 1974) better fits the Circum-Caribbean (c.f., Steward 1963) areas which constituted the Circum-Caribbean World-System, within which are several cores connected through extensive networks of movement, interaction, and exchange.

I hypothesize that there is not a one-way relationship and that Greater Nicoya and other Mesoamerica-influenced regions of the Isthmo-Colombian Area were neither “extra-systematic” nor only peripheral or frontier zones. Although Wallerstein (1974) initially developed world-systems theory for the analysis of state-level societies in the Mediterranean, Hall et al. (2011) argue persuasively that researchers must not equate the cores of world-systems with only state-level societies. Although there were no state-level societies in the Isthmo-Colombian Area,

Hoopes (2001) has argued that there were cores in the Isthmo-Colombian Area as well, and has postulated the existence of a world-system independent of Mesoamerica.

Preview of Methods

To test these hypotheses and achieve my research objectives, I am using a multifaceted methodological approach that includes archival and historical research, archaeological reconnaissance, and cost surface analyses in a geographic information system (GIS). In depth archival research at the National Archives of Costa Rica and the National Library of Costa Rica provided sufficient evidence to test for continuity between pre-Hispanic and historic human movement from the Central Highlands to the Caribbean Lowlands through the defined study area. Archaeological reconnaissance of roads and sites supplied a first step toward making observations about road construction methods, observing how roads and sites are situated on the landscape, looking for any associated archaeological record with historic roads, assessing the present condition of road preservation, and mapping the roads by collecting geographic coordinates with a global positioning system (GPS) unit. I use GIS to test my hypothesized landscapes of movement using cost surface analyses of least cost paths (LCPs) and least cost corridors (LCCs) in ESRI's ArcGIS® 10. These GIS queries provide mathematically modeled optimal landscapes of movement to test against actual landscapes of movement. When combined, these three methods provide a means to explore the fit of my hypotheses that require an understanding of the history, prehistory, and physical geography of the study area.

Summary

I use an interdisciplinary direct historical approach to hypothesize possible late pre-Hispanic landscapes of movement based on historic examples and then develop and apply a methodology for testing their existence and exploring their past functions. My principal

hypotheses are: (1) that the landscapes of movement extending outward from Nuevo Corinto are segments of an interregional network of movement, (2) that there is a correlation between the pre-Hispanic and historic landscapes of movement through the Cordillera Central, (3) that a world-systems analysis of the archaeological record can help us understand the functions of this network of movement within the larger cultural system during the late pre-Hispanic, and (4) that Nuevo Corinto was one of many late pre-Hispanic cores of a Circum-Caribbean World-System. To test my hypotheses, I interpret my findings by employing a world-systems analysis to situate these off-site archaeological features in the archaeological context of the Central Region and explore the past functions and properties of the routes. I place the hypothesized landscapes of movement within the larger network of movement—including waterscapes—and discuss models for the specific settlement of Nuevo Corinto within a hypothetical Circum-Caribbean World-System.

Preview of Chapters

In Chapter 2, I summarize the (1) landscape archaeology of roads, trails, and paths; (2) how a direct historical approach to ethnoarchaeological analogy can help reveal past roads, trails, and paths; and (3) a world-systems approach to gain a sense of the functions and properties these features once served. I uniquely combine these three theories to gain deeper understanding of both the scale and properties of past human movement.

In Chapter 3, I briefly describe the Central Region of Costa Rica and present summaries of formalized landscapes of movement documented at other architectonically complex archaeological sites of Period VI in this region. I go on to discern the network of movement of which all of these landscapes of movement were a part. Then, I turn to Nuevo Corinto and the

other archaeological sites of the La Unión District. Summarizing these sites, I interpret how their interconnectivity, exploring their known and unknown landscapes of movement.

In Chapter 4, I outline a multiple-method approach, which consist of archival investigations, archaeological reconnaissance, and GIS cost surface queries. Then, in Chapter 5, I present and interpret the history of human movement within my study area, the results of my preliminary reconnaissance, and the outcomes of my GIS LCPs and LCC analyses. In Chapter 6, I conclude my thesis and propose some areas of future research that will further develop our understandings of past human movement throughout the Central American Isthmus.

CHAPTER 2: THEORY

Roads, trails, and paths, as landscapes of movement, exist beyond the boundaries of the archaeological site (Snead et al. 2009a). While the *site* is the largest localized spatial unit on which most archaeological studies focus, it is an inadequate spatial unit for understanding the full range of daily activities the inhabitants of a community performed (Foley 1981), let alone the entire society. Those activities included movement for a multitude of purposes, within and among sites. Road, trail, and path features facilitated human movement across the cultural landscape, connecting habitation sites (i.e., villages and hamlets) to each other and to sites with other cultural functions. These features, especially those parts not composed of stone, deteriorate upon abandonment. I use a unique combination of landscape archaeology, the direct historical approach to ethnoarchaeological analogy, and world-systems theory to explore the scale and properties of landscapes of movement long since abandoned. I outline these three theories and my reasons for using them in this chapter.

Landscape Archaeologies

Landscapes of movement—all roads, trails, paths and associated features (Snead et al. 2009a)—and *waterscapes of movement*—all navigable rivers, canals, lakes, seas, oceans, and associated features used for aquatic transport—best fit into the realm of landscape archaeology. According to Bescherer Metheny (1996):

Landscape Archeology is concerned with both the conscious and unconscious shaping of the land: with the processes of organizing space or altering the land for a particular purpose, be it religious, economic, social, political, cultural, or symbolic; with the unintended consequences of land use and alteration; with the role and symbolic content

of landscape in its various contexts and its role in the construction of myth and history; and with the enactment and shaping of human behavior within the landscape.

The archaeology of landscapes helps to make sense of all facets of past cultural systems. With such a broadly defined goal, there has not been one landscape archaeology, but rather a multiplicity of landscape archaeologies without a common theory or approach⁶ (Heilen 2005; Wilkinson 2009:335). Landscape archaeology is not a theory, but a collection of theories, methods, and approaches with a common goal. Landscape archaeologists can be Processual, although most fall within the theoretical realms of Post-Processual Archaeologies⁷ (Bescherer Metheny 1996; Fleming 2006; Wilkinson 2009:335). No matter the theory or approach taken, this niche in archaeological research is an interdisciplinary endeavor that requires detailed understandings of ecosystems, landscape morphology, landscape history, and cultural systems.

Rather than present a comprehensive summary of landscape archaeology that includes the wide variety of what might be identified as “post-processual” approaches, I will focus on the processual approaches to the study of past cultural landscapes, emphasizing landscape archaeology as it pertains to human movement. Landscape archaeology, as I use it, is a form of “off site” archaeology (Foley 1981), interpreting cultural deposits as continuously distributed across the land. Sites—though originally defined by Willey and Phillips (1958:18) as “the minimum operational unit of geographic space” with “remains of former occupation”—are best known as those locations on the landscape with the highest concentration of material record or refuse deposits; those places where people butchered animals, camped, celebrated, or were

⁶ In his doctoral dissertation, Michael Heilen (2005) established a unified theory of landscape archaeology based in behavioral archaeology and network theory, but this has yet to catch much attention.

⁷ See Fleming (2006) for a good critique of Post-Processual landscape archaeology.

buried. However, sites do not capture the full range of human activity – the complete cultural system and network of interaction. Willey and Phillips (1958:18) noted that a site is “fairly continuously covered” with remains. To understand entire cultural systems, we must search well beyond the bounds of concentrated refuse deposits. As Wilkinson (2009:334) has said, “Although much archaeological data inevitably derive from the excavation of individual sites, it is the landscape that provides the context for much of those data.” This is what landscape archaeology is all about, looking at the whole picture of past human activity as it is naturally dispersed across the surface of the Earth, not just what occurs within the boundaries of a site or multiple sites. The roads, trails, and paths making up the landscapes of movement between sites (Snead et al. 2009a)—which are generally not considered “sites”—are prime examples of off-site archaeological features. I will apply archaeological theories of cultural landscapes to connect the sites of the La Unión District into larger patterns of human interaction and exchange.

Types of Communication, Transportation, and Routes

Before the Colonial Period, humans in the Americas either followed terrestrial routes (i.e., landscapes of movement) or made use of aquatic routes (i.e., waterscapes of movement) in their networks of interaction and exchange. These two genres of transportation routes can be divided even further into various categories that can aid in our understanding of the political and environmental situations in which each pre-Hispanic population lived. Particular types of routes are more effective than others, depending on the geographic and ecologic zone, as can be illustrated by their pre-Hispanic utilization in those areas. For example, the Maya elevated their causeways off the natural surface of the humid Yucatan Peninsula, while the former inhabitants of the Chaco Canyon in the arid American Southwest located their roads directly on the desert floor. Furthermore, archaeologists can find much valuable knowledge in the pattern of route

connectivity and the level of labor-intensiveness of the engineered design. Most pre-Hispanic American cultures made use of more than one type of movement in multiple ways and for various purposes.

Terrestrial Routes

Throughout the Americas, terrestrial routes of many different styles and patterns were formally constructed or created informally because of erosion initiated by repetitive, habitual use. Informal terrestrial routes were common for hunter-gatherers who utilized natural passes, such as river valleys and ridgeways, for their transportation needs. They did this because these natural passes are often the paths of least resistance between two points, although not always the most direct routes. River channels are often great natural markers to help guide travelers on their journeys, whatever their need for travel might be. Swerving around topographic obstacles, informal routes tend to be irregular in form. Hunter-gatherers had no obvious need to construct roads, but that did not mean they did not have their own trails. These informal routes were the result of necessity, being used repeatedly when migrating, hunting, gathering, trading, or doing any other cultural activity of mobility (Trombold 1991b:74-79).

Other paths did not follow least cost paths but passed over topographic obstacles, often in straight lines between cultural significant locales. The utilization of such paths indicates that sightline and visual criteria may have taken precedence over comfort (i.e., over optimal movement). These simple formalized routes were of greater cultural importance to the communities that created them than were other routes, signifying pedestrians used with more frequency. There also is a ritualistic explanation for this phenomenon, which may have been the reason for path linearity in some cultures. The best-known examples of linear pathways, believed

to have been created by habitual ritualistic use, are the *ceques*,⁸ which are said to have extended out from the center of Cuzco, Peru to divide the Inka Empire into sections (Zuidema 1964). However, the *ceques* were zigzag lines, not straight lines, and did not really divide the empire. Recent research has shown that these paths were not completely linear but instead zigzagged across the landscape connecting important religious shrines to one another (Bauer 1992:202). The paths between each shrine are still linear, a feature interpreted as having been important to the priests who followed these routes ritualistically (Bauer 1992:186). Similarly, pathways found in Costa Rica connecting settlements to cemeteries and other culturally significant locations not only retained their linearity but favored line-of-sight rectilinearity even over irregular topography, something indicative of a cultural ideology associated with ritual (McKee et al. 1994; Sever 1990; Sever and Sheets 2007; Sheets and Sever 1991). Rectilinear, line-of-sight pathways in both Costa Rica and Peru provide examples of ritualistic factors influencing patterns of human movement in two areas of the Americas.

Landscapes of Movement

As societies grew more complex, they began to formally construct and exercise control over their network of movement. Depending on the cultural and physical geography, these more complex landscapes of movement were stone-cleared, stone-curbed, stone-paved, sunken, or elevated. Several of these features could be present in one route, along with drainage culverts, bridges, sidewalls, ditches and other engineered elements. The construction methods of these roadways depended on the environments in which they were located and required some degree of organized labor. In the humid lowlands, communities built raised earthen roads and causeways to keep these routes passable during rainy weather when flooding is common. In drier areas,

⁸ *Ceques* is an Quechuan word meaning “lines.”

shallow trenches, stone-lined or stone-cleared paths are common. Communities constructed paved roads in elevated humid areas, where flooding is less common, but where the path surface could become muddy, potentially slowing the rate of travel (Trombold 1991b:3). As societies evolved, so did their landscapes of movement, evidenced by observed changes in pre-Hispanic Amerindian road construction and functions over time (Earle 1991). In reality, the methods of pre-Hispanic path construction are probably equal to the number of pre-Hispanic paths. Each constructed terrestrial route was different from the other in material and method, even though general trends can be interpreted cross-culturally.

Landscape archaeology examines the interface between the cultural processes and the environmental processes that shape and organize the land (Wilkinson 2009). Schiffer (1987:22) called these processes *c* (cultural) and *n* (natural) transformations. A detailed understanding of both of these processes is necessary to seek out past landscapes of movement. To search for such features, archaeologists first need an intimate knowledge of the geomorphological processes that might have preserved, altered, or destroyed them. Additionally, as a culture's uses for landscapes of movement change, the characteristics of the features change as well. This is illustrated over time by the gradual progression from informal paths to formally constructed cobble paved or entrenched roads in the immediate proximity of important habitation sites during the late pre-Hispanic in Costa Rica. Only a deep understanding of both of the cultural and natural processes behind landscapes of movement can reveal the extent and properties of the network of interaction and exchange, of which they are parts.

The scale and evolution of these features, however, requires other methods for interpretation. A combination of remote sensing and archaeological excavations is preferable to reveal the locations and the stratigraphy of these features. Nevertheless, other methods are

capable of revealing the scales of these features, even when their exact locations are not easily discernable. When archaeologists know interaction and exchange between locations occurred, they could use LCP and LCC queries in a GIS to simulate the trajectories of the landscapes of movement that facilitated this movement.

Waterscapes of Movement

Waterscapes of movement also varied because the infrastructures of most aquatic routes are due to natural hydrographic processes, with only a few constructed pre-Hispanic waterscapes of movement known in the Americas. Because of natural variation, every river, bay, lake, ocean, or canal has different characteristics. Some rivers are not navigable, or are only navigable in segments, while other rivers in lowland areas are almost completely traversable by canoe or raft. Transporting their canoes via portages, terrestrial routes linking navigable bodies of water, they avoided dangerous rapids and navigated a larger area. Seasonality of fluvial networks should also be considered when interpreting how people in the past used them for travel. In some parts of the planet, especially those tropical, certain seasons receive more precipitation than others do. Thus, for half of the year the river is prone to flooding while the other half of the year there is a diminished rate of water flow. This flood-drought, rainy-season/dry-season dichotomy had effects on the route options of Amerindians. However, when the water flow was moderate, fluvial routes allowed populations to trade larger quantities of goods more rapidly (Hassig 1991:25). Tides as well as recent rains can change the navigability of aquatic routes in a matter of hours, showing how use of reliable maritime transportation routes that can quickly turn dangerous requires sophisticated knowledge of the environment.

The archaeological and ethnohistorical evidence that we have for aquatic travel comes from the existence of watercraft throughout the Americas. Some archaeological examples

include a large collection of Archaic Period (5000 – 2300 B.C.) dugout canoes found buried in the lakebed sediments of Newnans Lake near Gainesville, Florida described by Wheeler et al. (2003) and the K'ak' Naab' canoe paddle that gave material evidence to the artistic depictions of Maya seafarers (McKillop 2010). People used such watercrafts in rivers throughout the Americas. We know that watercraft-borne Amerindians used rivers to connect to larger rivers, which gave access to bays, gulfs, seas, and the ocean. Accessing the ocean increased the possibilities for trade and the mingling of cultures.

Archaeologists cannot excavate pre-Hispanic ocean and sea navigation routes, for obvious reasons. However, these waterscapes of movement can be and are being simulated by such archaeologists as Callaghan (1999). He has used computers to simulate the routes that pre-Hispanic peoples were capable of traveling by random drift in canoe throughout the Circum-Caribbean world (Callaghan 1999, 2001, 2003a; Callaghan and Bray 2007) and elsewhere (Callaghan 2003b, c). Such innovative methods are shedding light on the waterscapes of movement of the seas that have interconnected populations near and far for millennia.

Considering the waterscapes of movement in my investigation of landscapes of movement helps discern the whole network of movement because transportation by river and sea were common. Even though I will not investigate waterscapes of movement here, they connected settlements in my study area to more settlements down river and surrounding the Caribbean Sea. Major rivers, such as the San Juan River and its confluences, connected these sites to the Caribbean Sea. To not acknowledge the importance of waterscapes of movement (see Callaghan 1999, 2001; Callaghan and Bray 2007) in the network of human movement would be to ignore a substantial mode of transportation that facilitated much human interregional movement.

Network Connectivity and Social Organization

Whether formal or informal, terrestrial or aquatic, the pattern of route network connectivity can reflect the social organization of a society. Combining economic theory with the study of roads provides models that inform interpretations of pre-Hispanic economy and the purposes routes served (Santley 1991:198) and can also help identify least cost routes that reveal culture-specific concepts about energetics and efficiency. Routes with dendritic network patterns display the importance of one or a few central settlements. Bounded networks show little connectivity between settlements, and thus less importance of intercommunity routes. Interlocking networks represent egalitarian communities where all settlements interacted with each other. Solar networks show the limited importance of one central place, but where many other settlements had influence on other groups. Thus, there may be a central site, but not all sites which are affiliated with it are directly connected to it (Santley 1991:199).

While two types of terrestrial routes existed in the latter part of the pre-Hispanic Era in the Americas, our knowledge of the inter- and intra-regional network of movement is far from complete. For example, the archaeological research of landscapes of movement in Mesoamerica has been mostly limited to formally constructed roadways, usually ignoring the footpaths of everyday use due to their virtual “invisibility” in the record. This is a common situation in the investigation of state societies and even those of chiefdoms. Archaeological evidence suggests Amerindian populations rarely constructed landscapes of movement for the use of traveling greater distances across the landscape. The possible exception to this is the Andean Region, where many cultures constructed extensive terrestrial routes that were later connected and further elaborated upon under the regime of the Inka Empire. Since a large amount of this network of movement was constructed, we know much more about it than any other pre-Hispanic communication network in the Americas.

In North America, where indigenous populations built few landscapes of movement, researchers have used Colonial documents, which indicate the locations of “Indian trails” and their reutilization as transportation routes by colonizers, to begin to piece together a roadmap of the pre-Colonial landscape. Ethnohistoric data has already helped us understand the use of waterscapes of movement, even though their importance to trade is not always given its due. Possibly, ethnohistoric research taking a direct historical approach will fill in the large gaps in the Isthmo-Colombian Area and other areas likely to have had extensive networks.

Direct Historical Approach

The direct historical approach (Steward 1942; Strong 1972; Wedel 1938) proceeds from the known to the unknown, working backwards, taking gradual steps deeper into time. Most commonly, this approach makes analogies between ethnographically observed human behavior and observations made from the archaeological record. Fenton (1949, 1952) called this same approach *upstreaming*. The direct historical approach is relevant to my thesis, because I am working from what is known about historic landscapes of movement and proceeding backward into the archaeological record to determine if there are any correlations between the routes people used in history and those of pre-Hispanic times in terms of general locations, properties, and scale. If the direct historical approach can reveal the locations and scale of the local pre-Hispanic network of movement from Nuevo Corinto outward, then there are many implications for this research in other study areas. I will utilize the direct historical approach by compiling historical records of human movement within the landscape between the Central Highlands and Nuevo Corinto to analogically derive hypotheses regarding the locations of late pre-Hispanic landscapes of movement.

Brief Background on Ethnoarchaeological Analogy

An analogy is a “comparison between two things, typically on the basis of their structure and for the purpose of explanation or clarification” (Hobson 2001:21). Ethnoarchaeological analogy is a method of formulating hypotheses about the behavior of the past inhabitants of an archaeological site based on ethnographic or historic observations. Ethnoarchaeological analogies are constructed based on perceived similarities between the artifacts or features that the archaeologist is studying and the material culture historically used by societies. Such analogical reasoning is based on the principle of uniformitarianism (Gould and Watson 1982). Lyell’s (1837) principle of uniformitarianism was initially described for its use in explaining geological processes. It states that general patterns and processes persist over time and can be projected into the past. The simplest analytic hypotheses state that the probable function of a particular class of features was the same as the historic function of similar features.

There are two types of ethnoarchaeological analogy: the direct historical approach and the comparative approach (Watson 1980). According to the direct historical approach, or the *folk-culture* approach of European prehistorians (Clark 1951), the modern or historic cultural source must be demonstrated to be a direct descendant of the artifact(s) under question (Lyman and O'Brien 2001; Steward 1942). In contrast, the comparative approach does not require a historic or cultural evolutionary connection, but the two cultures must manipulate similar environments in similar ways (Ascher 1961). To this day, most archaeologists prefer the direct historical approach and its assumptions of evolutionary continuity to the general comparative approach. Some archaeologists continue the debate by questioning the underpinning assumptions the direct historical approach relies upon (Lyman and O'Brien 2001).

Issues and Critiques of Ethnoarchaeological Analogy

Such critiques against analogical reasoning in archaeology are nothing new. Since the 1950s, there has been a discussion among archaeologists (Clark 1951; Smith 1955) and, more recently, ethnoarchaeologists (Binford 1967; Gould 1974, 1978, 1980; Gould and Watson 1982; Munson 1969; Watson 1980; Watson et al. 1971) about the relevance of analogical reasoning, like the direct historical approach, in the studies of past societies. One overarching critique of analogically rooted hypotheses is that they are often impossible to directly test (are teleological), and therefore are not capable of explaining the past. In addition, analogy is unable to address the diversity of human behavior, unless it takes a particularistic approach.

The uniformitarian principles that analogical arguments rely on assume that the processes behind an artifact in the archaeological record would be essentially the same as those in an ethnographic example of a similar artifact. Furthermore, the insistence on uniformitarian explanations rules out single-source analogical arguments in particular cases. Another problem is the ambiguity about the extent of generalization taken in making these arguments. In addition, the absence of any broadly accepted theories in archaeology is the root of another problem with utilizing analogy to achieve archaeological explanations, which attributes to the limited knowledge of the uniformities in human behavior across time that analogical reasoning depends on (Watson 1980). Wylie (1985:107) explains how the issues with analogical reasoning in archaeology only exhibit the need for standardizing its methodological use to raise its credibility and usability (also outlined in Wylie 1988).

Wylie (1982, 1985, 1988) has indicated that we still need analogy in order to project present-day uniformities into the past. This type of projection is unproblematic for geology, but many anthropologists have found such reasoning to be problematic for human sciences.

Archaeologists need to realize that the intended use of analogy is to establish testable probabilities and unlikelihoods and not to present deductive certainties.

While the aim of archaeology should be to build toward an understanding of the uniformitarian principles of human behavior, our sample size and understanding of the complexity of human culture limits our ability to achieve this (Watson 1980). Analogy provides a framework for comparing human behavior between past and present populations, directly or indirectly related, so that some day we might understand human nature. Even though analogy has been hotly debated among archaeologists in the past, for good reason it has outlived the critiques against it and continues to be employed.

The Direct Historical Approach and Networks of Movement

In this study of the late pre-Hispanic network of movement of northeastern Costa Rica, I use a direct historical approach to hypothesize landscapes of movement out of historical records documenting human movement between the Central Highlands and the land surrounding Nuevo Corinto. The assumption is that some uniformity remains in the way people move across a given landscape regardless of the period. Once a path has been initiated, it is much easier to continue to follow and improve upon the same path than to forge a new one (Castro Solera 2007).

There are some historical instances where researchers have observed such cross-temporal uniformities in patterns of human movement. Take for instance the mule trails of Costa Rica (Molina Montes de Oca 2005). Castro Solera (2007) found a direct correlation between the location of an historic mule trail and his proposed path between two important sites South Pacific Costa Rica. Such a methodology as that used by Castro Solera might prove useful at revealing additional pre-Hispanic long-distance trails.

There is a 300-year gap between the Period VI (A.D. 1000 – 1550) and the Liberal Period of Costa Rica (A.D. 1858 – 1921), when the historical landscape of movement was constructed. We might suppose that the major demographic and cultural changes that took place after the local population's first contact with Europeans in A.D. 1502 and throughout the Colonial Period (A.D. 1569 – 1821) led to either the abandonment or appropriation of pre-Hispanic landscapes of movement. Perhaps there is a correlation between the fate of each landscape of movement and the resultant demographic shifts of the Colonial Period. Where the population significantly declined or relocated, they abandoned the landscapes of movement. Where populations persisted or accumulated, they maintained or appropriated landscapes of movement. These changes might explain why indigenous landscapes of movement persisted through the dramatic cultural changes that took place during the Colonial Period. Another likely explanation for this might be that the guides who helped the explorers and later the colonizers navigate the terrain were themselves indigenous and familiar with the existent network of movement. The persistent use of the same landscapes of movement across the transition from the pre-Hispanic Era to the Modern Era is an example of historical inertia. This transition brought about rapid cultural change, resulting in a network of landscapes of movement where the initial purpose for the road or path has disappeared, but still use (or used) the same existing routes (mainly because they already exist).

Historical inertia is an important and common cultural process reflected in the archaeological record that can reveal parts of past cultural systems where cultural evolutionary processes have failed to erase all aspects of a system. While a direct historical approach might be useful for hypothesizing the locations of past landscapes of movement, it is important not to assume uniformities among the properties of the analog landscapes of movement. The function, the architectural style, and the mode of transportation of a landscape of movement all change,

evolving over time along with the culture of its users. Even the scale of a landscape of movement may not be comparable after centuries of cultural change and a growing incorporation in the world economy. The lesson learned from a century of utilizing the direct historical approach is to proceed with caution. Analogies are useful for producing hypotheses, not for testing them.

Using the direct historical approach, following the assumptions that uniformities of human movement exist and that it is much easier to use an existing path than to create a new one (e.g., historical inertia), I hypothesize only the general locations or trajectories of landscapes of movement during the late pre-Hispanic using historical analogs. To begin to analyze the functions, properties, and scale of the later pre-Hispanic landscape of movement, I turn to world-systems theory.

World-Systems Theory

Emerging out of sociology during the late 1960s and early 1970s (Frank 1967; Wallerstein 1974), world-systems theory has been the focus of much theory building by sociologists and archaeologists (Chase-Dunn and Hall 1993; Chase-Dunn and Hall 1991; Hall et al. 2011; Kardulias 1999; Kardulias and Hall 2008; Peregrine and Feinman 1996). Today, world-systems theory can be thought of as “a set of concepts and approaches that permits the study of large networks of human interaction over broad spaces” (Orser 2009:253). World-systems literature (1) provides a set of vocabulary for describing the way that communities interact among each other at varying scales and intensities, (2) provides a model for comparing various inter-community interactions and exchanges with each other, and (3) allows scholars interested in inter-community interactions and exchanges to generate testable hypotheses. To elucidate the functions and properties of landscapes of movement, as well as the scale of the network of movement, I will employ a world-systems analysis to describe and compare the intersite

interactions and exchanges of the hypothesized landscapes of movement within the context of the known archaeological record of the La Unión District, the districts of the Central Highland Subregion, and the Cordillera Central.

Brief Background on World-Systems Theory

Wallerstein (1974) used aspects of dependency theories (Amin 1974; Frank 1967), macrohistorical perspectives (Braudel 1966), and other theories of social change to formulate his world-systems theory to explain the rise of the capitalist system of Western Europe in the modern world. This theory of socioeconomic change contrasted markedly with unilineal models of social change that contemporaneously dominated social science. Rather than explain social change in an evolutionary or orthodox Marxist way, world-systems theory “explains change in terms of forces which originate outside of any particular local region or nation, in the dynamics of world economic organization” (Schneider 1991:45). One of the central principles of this theory is that the essential unit of analysis should be the world economy rather than the evolving regional or national society (Blanton and Feinman 1984:673). This world economy is described as consisting of a few highly centralized core groups who mobilize resources from an expansive peripheral domain (Schneider 1991:45). This universal theory of social change depends on interregional “competition between various geographically localized populations of unequal power” (i.e., the cores, semi-peripheries and peripheries) and the “differentiation, division of labor, and interdependence among the same units” (Schneider 1991:46).

In world-systems theory, the term *world* refers to a self-contained unit that is not necessarily (or normally) global or planetary. It builds on the concept that no place is entirely isolated and that there are gradients of density of interactions between core, peripheral, and semi-

peripheral areas that can sometimes be steep. When the level of interaction between regions becomes low, a boundary of a world-system can be defined (Kardulias and Hall 2008:574).

Wallerstein's greatest contribution to the social sciences was the development of a theory of social change applied to both Western and non-Western, traditional and modern societies at the same time (Schneider 1991:61). In the social sciences, the largest impact of this theory was Wallerstein's perspective that the economies of nations and societies in both the Westernized and non-Westernized regions of the world need to be conceptualized as being part of an open adaptive interregional interaction system. In addition, Wallerstein conceived of human history as being divided into three eras that were characterized by different types of systems: mini-systems, world empires, and world economies (Kohl 1987:3). He thought of the modern world-system as being the first world economy.

World-Systems Theory in Archaeology

This theory entered the realm of archaeology in attempts to expand the roots of the modern capitalist system in historic "economic empires" and move deeper into time. The potential place of archaeology in theory-building caused sociologists to delve into archaeological subject matter to build a better world-systems theoretical framework. In conjunction, archaeologists utilized and tested this developing framework. Since the first archaeologists began using this theoretical model for explaining archaeological problems, sociologists and archaeologists have extensively modified the theory to remove all of the original undesirable conceptual baggage of Wallerstein's theory.

World-systems theory was adopted and adapted by archaeologists for the perceived potential of the *world-system* as a unit of analysis capable of explaining the cultural evolution of any society on the planet within an open, complex, and adaptive system of interdependent,

interacting societies (Kohl 1987:2). It can investigate the role of connections between polities and interregional interactions in explaining sociopolitical development in earlier pre-capitalist *worlds* (Stein 1999a:40) in a way that “...links politics, economics, and geography into a unified framework that addresses the developmental processes of complex societies on a broad, interregional scale” (Stein 1999a:27). Being so dynamic, world-systems theory provides an interpretive advantage over other theories of interregional interaction.

Archaeology helped test world-systems theory on non-Western pre-capitalist subject matter to see if it could hold up. This revealed several inherent issues with world-systems theory as Wallerstein had presented it, including: the uses of core-periphery relations, notions of economic interdependence (Peregrine 1996), the false utilitarian/prestige good dichotomy, the false divide between the modern and pre-modern worlds (Schneider 1991), and the undefined need to utilize differences of scale (Kardulias and Hall 2008:574). Frank (1999), though critical of how world-systems theory has been applied in anthropology, notes that archaeological evidence and analysis has great potential to contribute to an understanding of how world-systems develop and evolve through time and to explain how the modern world-system emerged as it is.

The systematic forms and degree of coherency that a *world* can take are variable. Most world-system theorists use *system* to describe the sufficient density of interaction whereby events in one region of the *world* have significant effects elsewhere in the *world* structure, shaping its construction and influencing how the constituent parts change over time. Chase-Dunn and Hall (1997) addressed the issue of differing levels of interregional interaction by detailing how world-systems have at least four sets of boundaries. In ascending order of size, these are bulk goods networks, political-military networks, luxury or prestige good networks, and information networks. Only on small isolated islands or the contemporary planetary world-system do these

boundaries coincide with one another (Kardulias and Hall 2008:574). However, the network of movement of the world in question contained and facilitated these networks of various functions, with differing boundaries.

The participation of archeology in world-systems theorizing serves two symbiotic purposes. Of larger importance, it facilitates the betterment of world-systems theory as a unifying framework for social scientific inquiry capable of addressing human social evolution from the present to its origins in deep time. Secondly, this interaction develops an archaeological theory capable of explaining social change as it is situated within the interactive context of time and space (Frank 1999). The use of world-systems theorizing to the study of past networks of human movement serves the same purposes.

The Critique against World-Systems Theory

Gil Stein argues that theory building processes over the past few decades have resulted in a world-systems theory “so broadly defined and uncritically applied that it has lost any heuristic value, except as a shorthand for an interregional interaction system linking complex societies with other groups” (Stein 1999a:170). If Stein is right, the quantity of flawed conceptual baggage that comes with world-systems theory makes it necessary to drop the theory altogether. Frank (1999) responded to Stein’s (1999b) critiques and did not find merit to his argument to discard world-systems theory.

Despite Stein’s critiques, archaeologists continue to apply world-systems approaches. World-systems theory came at a time when an interregional interaction perspective was greatly needed to begin to see Western and non-Western societies as being part of the same system(s), influenced by the same socio-cultural trends and interdependent on each other. The plethora of

critiques from sociologists and archaeologists developed a world-systems theory capable of explaining social change across space and deep into time.

World-systems theory has demonstrated the need for macro-scale analyses of interregional human interactions in order to begin to understand the dynamic networks behind cultural change. These analyses have moved beyond the limits of trade economics, applying their methodologies to other sociocultural inquiries. As Kohl (1987:7) said in his early work on the potentials and critiques of world-systems theory, “[m]odels that only partially succeed or even fail also instruct, often in very important ways.” The instances when world-systems theory has not fully succeeded or even failed to explain socio-cultural evolutionary processes have only made the theory stronger. It would be counterproductive to dispose of the theory altogether. World-systems theory is capable of being, and has been, altered in response to problematic assumptions it contains. It presents a theoretical framework for explaining change in cultures throughout time and across the geographic landscape that is multilineal and adaptive.

World-Systems Theorizing and the Isthmo-Colombian Area

Linguistic, genetic, ethnohistorical, ethnographical, art historical, and archaeological evidence all point toward a pre-Hispanic Isthmo-Colombian Area that exhibited at least some level of interregional interaction independent of the neighboring state-level societies to the north and south (Hoopes and Fonseca Zamora 2003). The diverse mix of chiefdoms or complex-tribes (Habicht-Mauche et al. 1987; Hoopes 1988) that collectively comprised what has since been termed the *Isthmo-Colombian Area* can be thought of as a world-system, wherein various mini-systems⁹ interacted and exchanged goods and ideas in a network or series of segmentary lineages (Hoopes 2001:19). Such mini-systems had a “short-term fission-fusion structure [that] produced

⁹ These mini-systems might correlate to the chiefdoms or complex tribes of the area.

long-term stability” (Hoopes 2001:4). Hoopes goes on to say that “‘Diffuse unity’ characterized by loose and fluid affiliations among groups, may be a pattern of the larger system that reproduces the dynamics of segmentary village-hamlet kinship units” (Hoopes 2001:4-5).

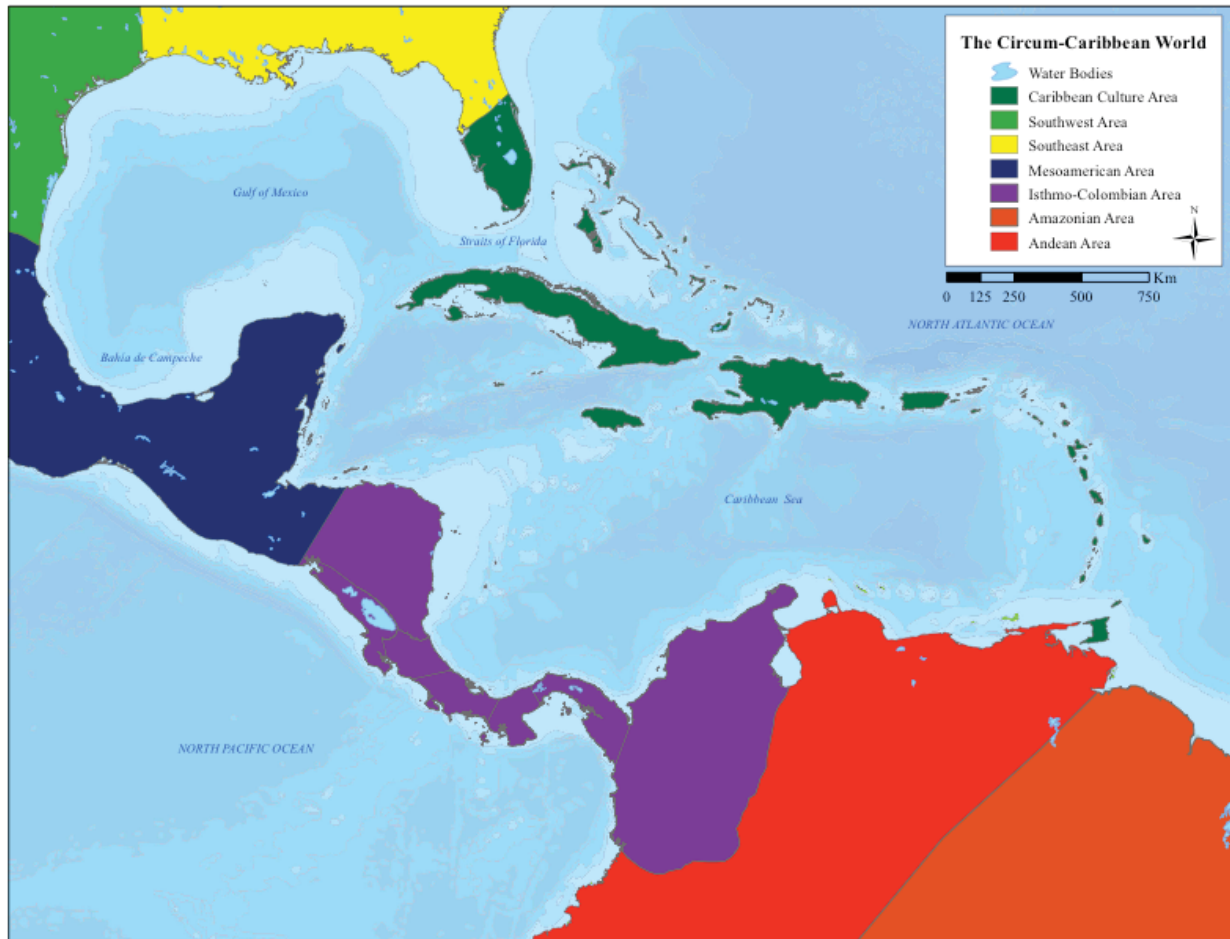


Figure 4. The many cultures that surround the Caribbean Sea were likely all part of one world-system. The Isthmo-Colombian Area was an important part of that world.

Hoopes demonstrates how the Chibchan world was not peripheral to the Mesoamerican world due to minimal evidence of two-way interaction between the Mesoamerican cores and those of the Isthmo-Colombian Area (Hoopes 2001:5). A possible exception to this might be the jade trade discussed by Mora-Marín (2005). Mora-Marín also used a world-systems analysis, but

in his research he focused on examples of prestige goods exchanges and discussed a world-systemic shift related to the switch from the preferred medium of jade to gold in the manufacture of prestige goods that occurred around A.D. 700.

The existence or extent of this world-system may have varied over time. For example, Carmack and Salgado González (2006:219) argue that the Greater Nicoya Subarea, the upper Pacific coastal region of the Isthmo-Colombian Area, is “best understood as part of the Mesoamerican world-system” during the post-Classic period. However, they go on to note that the communities of the Greater Nicoya Subarea were simultaneously part of the Chibchan world (i.e., the Isthmo-Colombian Area), which they described as the southern “frontier” zone beyond the Mesoamerican periphery¹⁰ (Carmack and Salgado González 2006:226). This signifies that the peoples of Greater Nicoya participated in two world-systems. The implications of overlapping or intersecting world-systems in Greater Nicoya still need to be explored.

Hall et al. (2011) argue persuasively that researchers must not equate the cores of world-systems with only state-level societies. Although there were not state-level societies in the Isthmo-Colombian Area, Hoopes (2001) successfully argued that there were cores in the Isthmo-Colombian Area as well, indicating it is part of a world-system independent of Mesoamerica. However, we must not equate the Isthmo-Colombian Area with a world-system.

Based on new research (Rodríguez Ramos 2010; Rodríguez Ramos and Pagán Jiménez 2006) the pre-Hispanic peoples of the Central American Isthmus and northern South America

¹⁰ I would posit that there is not a one-way relationship and that Greater Nicoya and other Mesoamerica-influenced regions of the Isthmo-Colombian Area were neither “extra-systematic” nor only peripheral or frontier zones.

participated in regarding sociopolitical interaction spheres¹¹ (cf. Caldwell 1964) between the Caribbean islands and Isthmo-Colombian Area during the pre-Hispanic Era. I go one step further to suppose the existence of a Circum-Caribbean World-System (see Figure 4), because a world-systems model better fits the Circum-Caribbean (Steward 1963) within which are numerous cores connected through extensive networks of movement, of interaction and exchange. Similar arguments have already been introduced by Hoopes (2008) in a model that he has called the *American Mediterranean*. Taking a significant departure from his thinking in 2001, Hoopes (2008) hypothesized the Caribbean Sea served similar functions for interaction and exchange as the Mediterranean Sea did in the Old World.

I will not produce a comprehensive argument for the existence of a pre-Hispanic Circum-Caribbean World-System, because it is a task beyond the scope of this thesis. The emphasis of this work is not to analyze interaction and exchange at the macrospatial scale of the entire world or area, but at the local and regional scales. While a world-systems perspective is most useful at the macro-scale, some scholars have attempted to use it to study small isolated groups or specific regions (Chase-Dunn and Mann 1998). I will do the same to interpret my findings.

Justification for Using World-Systems Theory

The concept of a world-system helps with the interpretation of a cultural landscape within which the network of movement is conditioned by, shapes, and reflects political and social influences and how those influences have changed over time. To use an anatomical metaphor, networks of movement are the circulatory systems of world-systems. Interactions and exchanges within this world-system largely occurred along the landscapes of movement and waterscapes of

¹¹ I draw from world-systems theory, rather than the interaction spheres literature, because it provides a dynamic theoretical framework and terminology capable of explaining and describing both macro- and micro- interregional interactions.

movement. The entire network of movement used by a society is then interconnected with those of neighboring societies. While trade was not the only function of these networks, traded non-perishable items are the most obvious evidence of these interactions. However, “most routes can have multiple functions including subsistence, trade, socializing, war, and ceremony” (Earle 2009:255), and analyzing the material record found in association with such routes might indicate their particular functions.

Positing a macro-scale Circum-Caribbean World-System provides a framework for interpreting Nuevo Corinto as a core or important semi-periphery in of the Línea Vieja Subregion and for understanding the plethora of functions and the properties held by the landscapes and waterscapes of movement that connect the site into the larger world-system. Using a world-systems analysis also helps reveal the scale of the network of movement. I will employ world-systems theory to analyze the hypothesized landscapes of movement within the context of the known archaeological record of the La Unión District, the Central Highlands Subregion, and the Cordillera Central.

Summary

In this chapter, I briefly described each of three theories I use to learn about the scale and properties of late pre-Hispanic human movement and detail how I will apply them throughout my investigation of landscapes of movement. Landscape archaeology theories and approaches look broadly at the land inhabited by past cultures, including the roads, trails, and paths that human populations depended on for a multitude of sociocultural purposes. The direct historical approach makes it possible to dig deeper into time, beginning with the ethnohistoric record and working backward in time with analogical reasoning, to explore the potential of uniformities in human movement across the historic/pre-historic transition. The landscape of movement I

investigate in this thesis is not yet identifiable in the archaeological record beyond the bounds of the Nuevo Corinto site. However, making and testing analogies based on historically described movement could assist our explanations of prehistoric human movement. This landscape of movement did not exist in isolation from other routes of human movement. To begin to understand the socio-cultural functions it might have served in the *network of movement*, I turn to world-systems theory. World-systems terminology of *core*, *semi-periphery*, and *periphery* are helpful for describing the relationship among sites, districts, and regions.

CHAPTER 3: THE CENTRAL REGION AND ITS LANDSCAPES OF MOVEMENT

The Central Region as Part of the Isthmo-Colombian Area

Between Mesoamerica and the Central Andes, the Isthmo-Colombian Cultural Area (Hoopes and Fonseca Zamora 2003) refers to that area of Central America and northern South America that was home to indigenous populations linguistically, genetically, and culturally similar during pre-Hispanic times (Figure 4). The Central Region is at the core of the Isthmo-Colombian Area, consisting of all of the Caribbean Watershed and the Central Pacific Watershed of the modern nation of Costa Rica. This region captures a great deal of diversity in landscape, and it contained cultural diversity during the pre-Hispanic Era. During Period VI, the Central Region was home to several powerful chiefdoms with large territories, which, at least near their most important settlements, constructed roads. Since the beginning of scientific archaeology in Costa Rica, researchers have divided the Central Region into subregions. In this chapter, I briefly summarize the current archaeological understandings of those subregions and describe some of the more important landscapes of movement within each. Then, I narrow my focus to the La Unión (Archaeological) District and the site of Nuevo Corinto, exploring how this village was interconnected with neighboring sites forming one community.

The inhabitants of the Isthmo-Colombian Cultural Area spoke languages of the Macro-Chibchan family (Constenla Umaña 1981), and iconographic analyses have revealed that they also shared a common world-view (Hoopes and Fonseca Zamora 2003). The *Isthmo-Colombian Cultural Area* is an attempt to find an emic cultural classification, one that would have been more meaningful to these past peoples, rather than the etic concepts of an *Intermediate Area* (Wiley 1959) or *Lower Central America* (Lothrop 1961), which anthropologists have used for

their own extrinsic analytic purposes. This attempt has developed out of a growing state of discontent with these terms, because they were arbitrarily delimited based on their geographic position between the state-level societies to the north and south rather than internal commonalities (Hoopes and Fonseca Zamora 2003).

The Isthmo-Colombian Cultural Area can be conceptualized as consisting of various “cultural spheres” throughout most of its prehistory, as Snarskis (2003:159) has described the archaeology of Costa Rica. However, archaeologists have yet to understand the cultural paleogeographies and cultural landscapes of this expansive region. Thus, the extent or boundaries of the cultural spheres cannot yet be clearly defined. Traditionally, archaeologists and prehistorians, beginning with Lines (1938), have described these cultural spheres as archaeological regions that were based as much on physical and modern political geography as past cultural similarities. Throughout the history of Isthmo-Colombian Cultural Area archaeology, researchers have adjusted the archaeological regions/subareas to better reflect the spheres of cultural influence indicated in the material record. One way archaeologists accomplished this was by not confining archaeological subareas within modern national borders, resulting in the development of such terminology as Greater Chiriquí and Greater Nicoya. However, the Central Region of Costa Rica (to be defined below) remains descriptively bounded within Costa Rica between the borders of Nicaragua and Panama to the north and south.

This has been partially the result of limited archaeological research in the north of the Caribbean Lowlands of the isthmus as a whole, but especially the Northern Zone in Nicaragua. Of this entire region, the Caribbean Lowlands and Central Highlands of Costa Rica are the best understood and researched, but much of the research is outdated and continues to be either culture-historic or ethnohistoric in nature. While these have proven to be useful methods in

beginning to understand the dynamics of pre-Hispanic indigenous societies of the isthmus, we have much research to conduct to explain the complexities of the material record. Even Snarskis (1978) mentions the need to go beyond explications to find explanations of the archaeological record, but in sectors of the isthmus, especially the Caribbean Lowlands, this type of research has been limited.

The site of Nuevo Corinto lies within the “Core of the Isthmo-Colombian Area” (Hoopes and Fonseca Zamora 2003:55-57) and specifically within what is termed the Línea Vieja Subregion of the Central (Archaeological) Region of Costa Rica. The geographically dynamic Central Region consists of the Caribbean Lowlands, Central Highlands, and the Central Pacific Coast of Costa Rica. This geographic division dates back to as far as the work of Lines (1938). Bounding the Central Region to the north is the San Juan River, to the east the Caribbean Sea, to the south the Sixaola River, and to the west a combination of the Pacific Ocean and the mountain ranges Guanacaste, Tilarán, and Talamanca. Within its territory, this region includes the Caribbean Plain (the Guatuso, San Carlos, and Santa Clara plains), the Cordillera Central, the Central Valley (Stone 1966:15), and the Central Pacific Slope. Stone (1966) refers to what has become known as the Central Region as the “Atlantic Watershed and the Highland Region,” whereas Snarskis (1998) calls it the “Central Highlands-Atlantic Watershed (CH-AW) region.” Both Snarskis and Stone follow a larger trend of identifying the sea to the east as the “Atlantic Ocean” when it is most definitely the Caribbean Sea, a realization that is becoming increasingly more important to understanding the dynamics of pre-Hispanic interregional interaction and exchange.

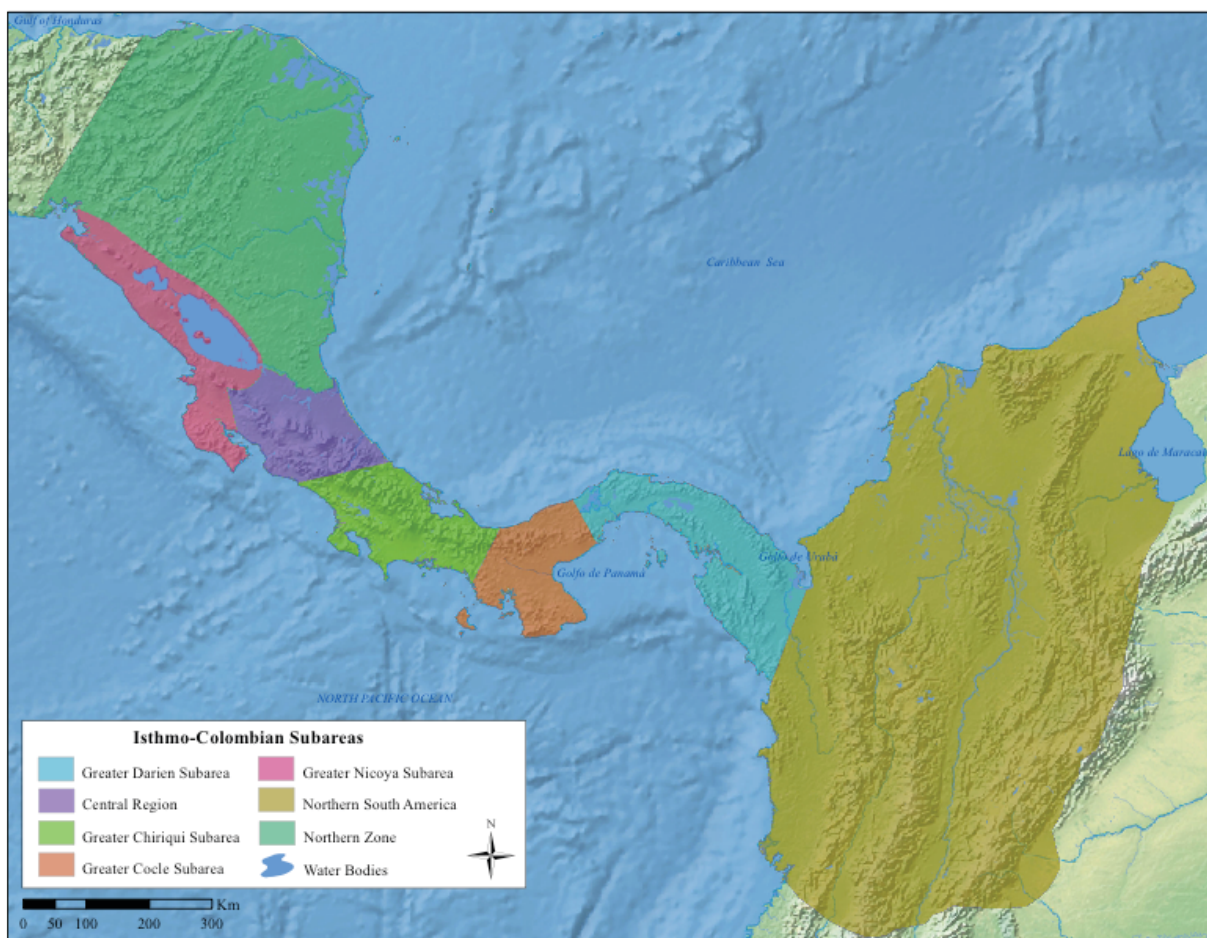


Figure 5. There are at least seven subareas of the Isthmo-Colombian Area, although Northern South American and the so-called Northern Zone are not as divided as Panama and Costa Rica have been (Carmack and Salgado González 2006:Figure 1; Cooke 2005:Figure 2; Hoopes 2005:Figure 1; Jones 1992:Figure 20).

The Central Region¹² is adjacent to the Greater Nicoya Subarea (Lange 1984; Norweb 1961, 1964) in the west and to Greater Chiriquí Subarea (Haberland 1961, 1984)¹³ to the south (Figure 5). To the west of the Guanacaste and Tilarán mountain ranges, the Greater Nicoya

¹² I treat the Central Region as an archaeological subarea.

¹³ Haberland (1984) refers to Greater Chiriquí as a “cultural area” made up of several “subareas.” To be consistent with my definitions of these spatial terms and include our present archaeological knowledge of the isthmus, I will refer to Greater Chiriquí as a subarea.

Subarea includes all of the Nicoya Peninsula, as well as the territory that extends up and along the western coast of Nicaragua to the Gulf of Fonseca, Honduras (Corrales Ulloa and Quintanilla Jiménez 1996:94). The Greater Chiriquí Subarea spans much of the modern Panamanian provinces of Chiriquí, Bocas del Torro, and the Ngöbe-Buglé Comarca along with the Costa Rican geographic regions of the western highlands of Costa Rica, the Diquís Delta Subregion, the Térraba-Coto Brús subregion, the Osa Peninsula, the Golfo Dulce, and the Fila Costeña subregion. Altogether, this subarea consists of ten or eleven archaeological subregions as defined by Hoopes (1996:43) after (Haberland 1961, 1984). These subareas are not as clearly distinct from the Central Region as the literature indicates. John Hoopes (personal communication, 2011) thinks that the existence of the Greater Chiriquí Subarea, Greater Nicoya Subarea, and Central Region is a remnant of the incorrect notion that this portion of the isthmus was a frontier zone, or Intermediate Area, between South American and Mesoamerican cultures rather than an Isthmo-Colombian Area (Hoopes and Fonseca Zamora 2003) with its own distinct identity and characteristics. The utility of these distinctions and the terminology used for them needs to be thoroughly examined in light of the current data. The existing terminology remains a potential source of confusion where clarity is required.

Archaeologists have detected few footpaths similar to those reported by Sheets and Sever (1991) at Las Piedras (G-152 LP), Neblina (G-151 Ne), and El Silencio (G-150 ES) in the Arenal district in the Central Region (also see Butler 2005; McKee and Sever 1994; McKee et al. 1994; Sever and Sheets 2007; Sever et al. 2003; Sheets 2009), but this region also contains the most information about late pre-Hispanic Period formalized road networks associated with mound architectural complexes (see Figure 2). By Period VI (A.D. 1000 – 1550) of the Central Region, socially and architectonically complex settlements grew and included such structures as mounds,

foundations, and paved roads Politically, these settlements appear to have been organized into chiefdoms or complex tribes where centralized authority controlled the workforce and principal towns (i.e., cores) reined over subordinate villages (i.e., peripheries) (Corrales Ulloa and Quintanilla Jiménez 1996:106). By around A.D. 600, major habitation sites of the Central Region, such as Las Mercedes-1 (L-289 LM-1), Agua Caliente (C-35 AC), Anita Grande (L-53 AG), Monumento Nacional Guayabo (C-362 MNG), and Cutris (A-21 Ct), presented intra- and inter-settlement cobble-paved roads, probably constructed by these controlled workforces. In addition, Monumento Nacional Guayabo, Las Mercedes-1, and a number of other sites have structures that may have served as checkpoints or surveillance stations that mark beginning and ending points along the paved roads approaching the center of the site. At some point, a road network likely connected many or all of the sites in this region. However, anthropogenic and geomorphologic landscape changes have erased some road and path segments, causing difficulties in the discernment of this network of movement (Troyo Vargas and Guerrero Miranda 1998:84).

Based on the diverse archaeological record, the Caribbean Lowlands of Costa Rica and Nicaragua were once great trading zones for Circum-Caribbean cultures. Here, the long flat plains, divided only by low groups of hills, contain hydrographic networks that are navigable for shallow craft. These rivers provided easy access to the mountain passes that acted as natural gateways to the isthmian highlands and beyond to the Pacific. The massive San Juan River, with its many tributaries, was of particular importance for trade and communication between neighboring chiefdoms as well as merchants from afar. While canoe traffic is permitted near the mouths of many of the rivers emptying into the Caribbean Sea, the San Juan, the Reventazón, the Estrella, and the Sixaola are navigable by canoe a considerable distance up river. The Central

Region also contains the large Tortugero freshwater lagoon and La Uvita, a large offshore island that would have offered shelter to seafarers during storms (Stone 1966:15).

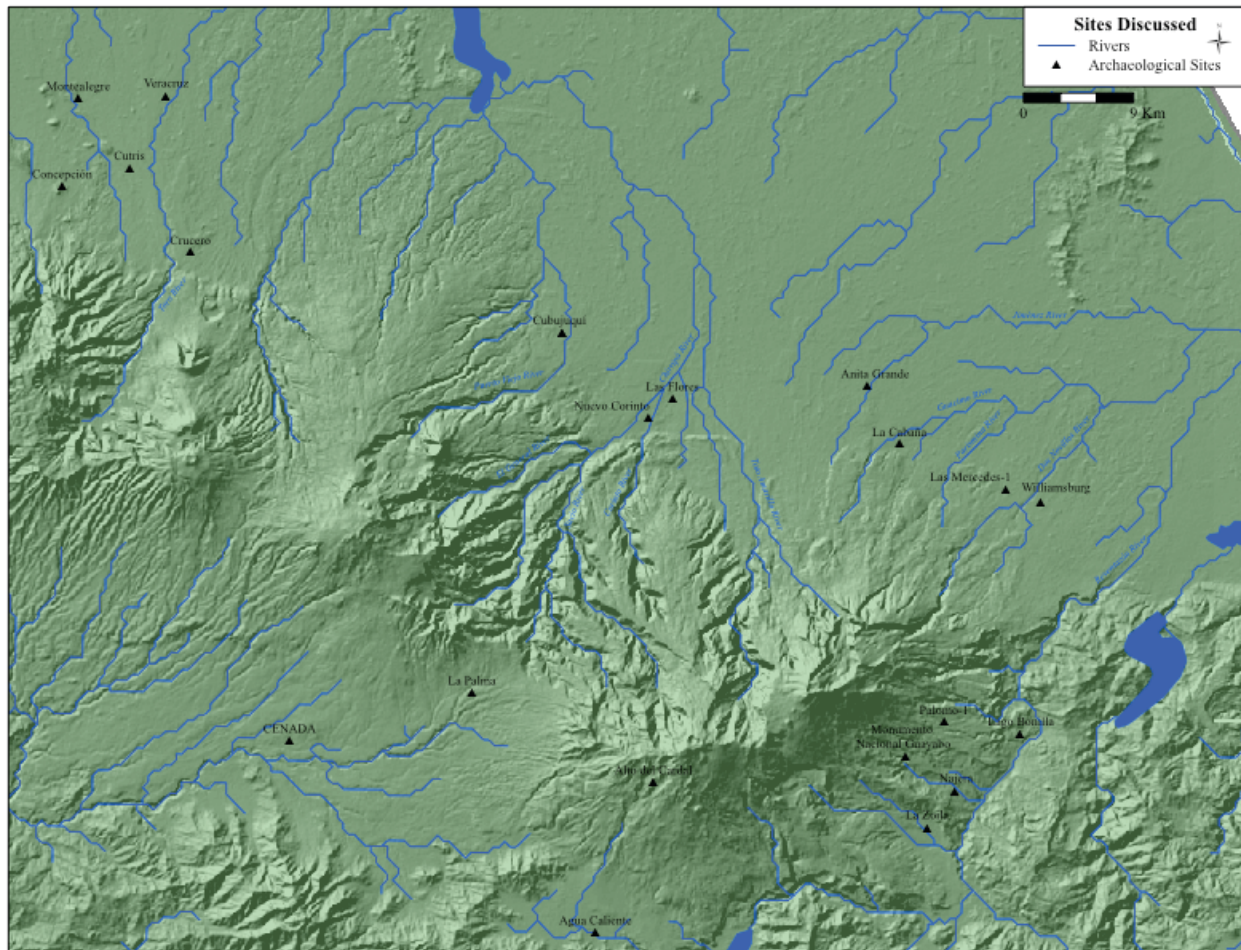


Figure 6. This map shows the locations of the sites I will discuss in the following section.

The Landscapes of Movement of the Central Region

Despite the obvious problems with the term *Central Region*, I attempt to synthesize the present archaeological knowledge of this region as described in the literature, focusing on its landscapes of movement. Stone (1977:168) states that characteristic cobble-paved roads of this region, measuring anywhere from one to seven meters wide, connected house mounds, led to nearby creeks or rivers, and often connected with neighboring sites. Here, I attempt to produce a

summary to aid in the development of our understanding of the local and regional patterns of human movement among the communities of the Central Region. I discuss the Central Region as being divided into five subregions¹⁴: the Línea Vieja Subregion, the Reventazón Subregion, the Central Highlands Subregion (Stone 1966:15), the Central Pacific Slope Subregion (Corrales Ulloa 1992), and the Northern Slope Subregion (Gutiérrez González and Mora Sierra 1988). I tentatively use these subregions to mediate our spacio-inferential attention between regional and local processes as I describe the known landscapes of movement within them. I focus on the Línea Vieja and Central Highlands subregions, because a deeper understanding of the late pre-Hispanic interactions and exchanges between these two subregions is essential to test the hypotheses of my thesis. By describing road and path features in other subregions, I emphasize both the cultural variability and continuities of landscapes of movement in the Central Region.

The Central Pacific Slope Subregion

The archaeology of this subregion was poorly known until the systematic archaeological investigation conducted by the Museo Nacional de Costa Rica's (MNCR) Proyecto Arqueológico del Pacífico Central (PAPC) from 1986 to 1990 (Corrales Ulloa 1992; Corrales Ulloa and Quintanilla Jiménez 1996). The results of this project showed that the Period VI habitation sites of Jesús María (A-321 JM) (Solís Alpizar 1992) and Lomas Entierros (SJ-343 LE) (Solís del Vecchio and Herrera Villalobos 1992), among others in the subregion, controlled access to of important fluvial waterscapes of movement, such as the Jesús María River and the Tárcoles River. Merchants used these rivers to trade goods between southern Greater Nicoya and the Central Highlands (Corrales Ulloa and Quintanilla Jiménez 1992, 1996). Due to the intermediary position of the sites in this subregion, they served as important waypoints and/or

¹⁴ These subregions remain etic, and require reevaluation.

market places for trade goods from both the northwest and east. Some sites, like La Malla (P-338 LM) in the Tivives Mangroves, contributed marine resources to the trade network (Quintanilla Jiménez 1992). Lomas Entierros and Jesús María likely had important landscapes of movement associated with them, however we presently do not know much about the landscapes of movement within the Central Pacific Slope Subregion.

The Central Highland Subregion

The history of archaeological research in the Central Highlands began in the late 1800s when amateur archaeologists (Alfaro González 1893, 1894; Navarrete 1899; Peralta and Alfaro González 1893; Polakowsky 1890) and visiting archaeologists, like Hartman (1901), first wrote of their findings from excavations. Early in the 20th Century, additional amateur archaeologists, like Tristán (1922, 1924, 2007) and Lines (1938) made numerous early contributions to the archaeology of the Central Highlands. While the quantity and quality of archaeological research improved up to today, our understanding of the cultural processes in the Central Highland Subregion is still primarily limited to small studies on specific sites, much of which remains in the gray literature. Our understanding of the late pre-Hispanic communities of the Central Highlands has included knowledge of roads and paths since the earliest research. However, we still do not know much about the landscapes of movement throughout this subregion.

Agua Caliente (C-35 AC) is one of the most researched archaeological sites in the Central Highland Subregion. Research began at the site as early as 1887 (Polakowsky 1888 cited in Peytrequín Gómez 2009) and many studies have been conducted at or in the vicinity of the site, since (Achío Fuentes 2007; Solís Alpizar et al. 1988; Valerio Lobo 1989; Valerio Lobo et al. 1986; Vázquez Leiva 1989). Most recently, Peytrequín Gómez and Aguilar Bonilla (Peytrequín Gómez 2007, 2009; Peytrequín Gómez and Aguilar Bonilla 2007a, b) have revisited Agua

Caliente, conducted additional research, and published the most current descriptions and interpretations of the site's material record.

The site of Agua Caliente was the largest and most influential archaeological site in the Guarco Valley, being the center of local economic, political, social, and religious functions (Peytrequín Gómez and Aguilar Bonilla 2007b). The community of Agua Caliente reached its climax of importance during Period VI when much of the site's architecture (mounds, dams, roads, and other structures) was constructed (Peytrequín Gómez 2009:47).

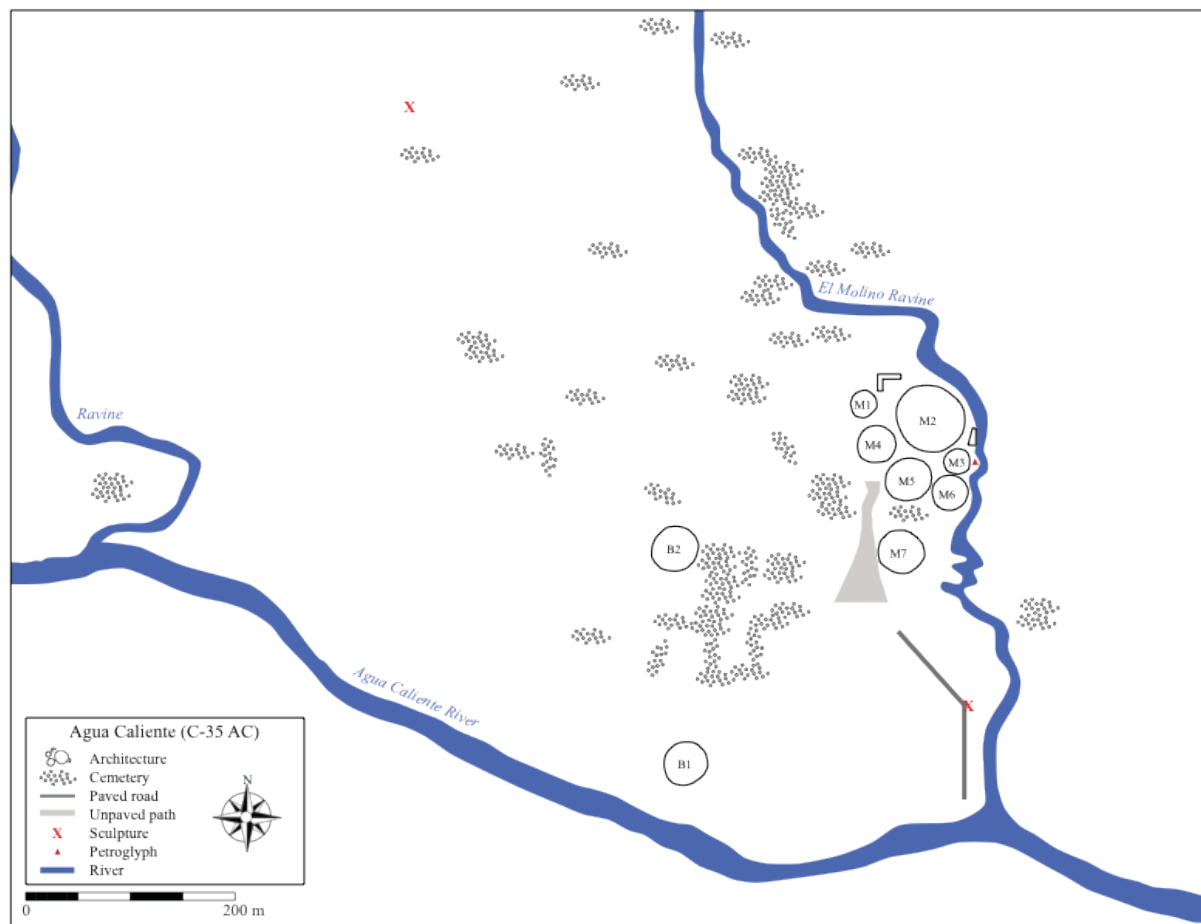


Figure 7. Map of the central architectural and funerary complex of the Agua Caliente site (C-35 AC) (redrawn after Peytrequín Gómez 2009:45-46).

Agua Caliente has two cobblestone-paved roads and at least one unpaved road or path. Peytrequín Gómez (2009:42) described these features as “una calzada con dos ramales,” because both of the roads are located in the same sector of the site next to the El Molina Stream, one parallel (approximately north to south) and the other perpendicular to it (approximately northwest west to southeast east). These roads are similar in size; one being constructed seven, and the other five, rows of cobblestones wide. It is likely that the northwest bound road continued straight, bisecting the architectural and funerary complex of the site and connecting it to neighboring sectors. The other road segment probably crossed the Agua Caliente River and continued southward to facilitate communication among parts of the site with the architectural and funerary complex (ibid.). Peytrequín Gómez (2009:49) mentions that the surrounding small villages and hamlets, described by Valerio Lobo (1989) and Solís Alpizar et al. (1988), constituted Agua Caliente’s immediate sphere of interaction, and would have been connected to this political, economic, ritual, and social center by way of the roads described above and Agua Caliente River and El Molino Stream.

The path situated directly to the west of Mound 7 runs more or less from south to north. The width of this path is irregular and its length and eventual destination are unknown. The pre-Hispanic engineers of this path constructed it as an entrenchment with earthen curbs. The curb on the western side is associated with a funerary area and is 2.39 meters high. The curb on the eastern side is approximately 1.15 meters high and connects to Mound 7. Pedestrians would have entered and exited Mound 7 by way of this path. The path was oriented with the paved roads in such a way that when the pavement of the road that runs northwest west to southeast east comes to an end, the path is only a short distance away (Peytrequín Gómez 2009:44).

Besides the roads at Agua Caliente, archaeologists have published descriptions of few other pre-Hispanic roads in the Central Highlands. Cavallini Morales (2011) recently published a preliminary report on her research regarding the stone-paved roads reported in association with Alto del Cardal (C-304 AC). As part of her Master's research, she has mapped road and path segments and collected accounts describing these roads. Additionally, the site of La Palma (SJ-501 LP), near San Jerónimo de Moravia, and La Laguna (SJ-499 LL) have roads feature first mentioned by Tristán (2007:64-65, 109) in the early 20th Century. In Chapter 5, I summarize Tristán description of La Palma and present a summary of the research I conducted with Marco Arce of the University of Costa Rica (UCR) in 2010 at this site. CENADA (H-26 CENADA), located near Barreal de Heredia, is reported to have had at least eight mounds dating to Period VI (Gutiérrez González 1986:257). Even though this site does not have document road features, I will use it as a possible destination in my least cost path models because it was another population center in the Central Highlands.

The Northern Slope Subregion

The archaeology of the Northern Slope Subregion has been very limited. The San Carlos and Guatuso plains, the northernmost portion of the lowlands in Costa Rica, primarily define this subregion. If we include the Arenal District in this subregion, the most intensive research conducted here is in the vicinity of the Arenal Volcano, where pre-Hispanic footpaths were revealed using remote sensing techniques (Butler 2005; McKee and Sever 1994; McKee et al. 1994; Sever and Sheets 2007; Sever et al. 2003; Sheets 2009; Sheets and Sever 1991). These footpaths remain the most researched and published pre-Hispanic landscapes of movement in the Central American Isthmus. Additionally, Cutris (A-21 Ct) and Cubujuquí (H-7 Cq) are two of the most important archaeological sites in this subregion with documented road features.

The *Projecto Prehistorico Arenal* (PPA) is an archaeological project that began in the early 1980s and conducted an expansive archaeological survey of the district around the Arenal Volcano of northwestern Costa Rica (Sheets and McKee 1994). The most recent field season of the PPA was in 2002-2003 (see *Vínculos* 28). This project produced many significant contributions to archaeological knowledge, but here I focus on the prehistoric footpaths. These footpaths were detected and mapped throughout the field seasons of the PPA using a combination of remote sensing with ground-truthing excavations to verify and date footpath fragments (McKee and Sever 1994; McKee et al. 1994; Sever 1990; Sever et al. 2003; Sheets 1994; Sheets and Sever 1991). In the 1980s, this was the first time such a remote sensing archaeological study was conducted and many of the early publications focused primarily on the innovative methodology that was used (Butler 2005).

Near El Silencio (G-150 ES), linear anomalies were detected by aerial remote sensing technology and later verified as three footpaths beneath up to three meters of volcanic ash (McKee et al. 1994:143). This information, preserved in ash, permits us to see how the former inhabitants mobilized themselves and communicated about the pre-Hispanic landscape (Sever et al. 2003:9). The clear volcanic stratigraphy of the initial excavations indicated that some of these footpaths were formed around 1500 B.C. (McKee et al. 1994:143), and more investigations showed that these features persisted from 500 B.C. to A.D. 1300 (Sever et al. 2003:9). The footpaths were mainly located along elevated terrain in a way that allowed for more drainage compared to lower elevation routes, an important feature in an area with a humid climate (McKee et al. 1994:145). Here, human behaviors caused the unintentional formation of sunken footpaths as humans walked about the surface of the path killing vegetation, compacting the soil, and initiating erosion (McKee et al. 1994:147).

These footpaths connected settlements, a natural spring, a cemetery, and an andesite quarry. It appears that the inhabitants of the site used these routes to transport blocks of andesite for use in the construction of graves, deceased individuals for burial, and funerary parades (McKee et al. 1994:153). The stratigraphy shows that the inhabitants followed the same route to enter and exit the cemetery over a long period of time, forming a slight depression that eventually eroded into a deep and wide trench (McKee et al. 1994:152). The duration and intensity of footpath use remains unknown, but the investigators believe that the repetitive use was based on a religious belief that to enter and exit the cemetery was a formalized behavior based on religious symbolic belief that valued rectilinear, line-of-sight processions toward significant cultural locales (Butler 2005; Sever and Sheets 2007; Sever et al. 2003:11, 15; Sheets 2009). By the late pre-Hispanic Period, the observed footpaths in the Arenal District seem to have fallen out of use. Exactly why this abandonment occurred still needs to be determined.

Cutris was built in the northern part of the Plains of San Carlos with prominent views of the Poas and Arenal volcanoes (Troyo Vargas and Guerrero Miranda 1998:86), and access to the Caribbean Sea by way of the rivers Guayabo, Tres Amigos, and Toro, tributaries of the San Juan River (Vázquez Leiva et al. 2003:151). During the Period VI, Curtis appears to have been the central village of a chiefdom, whose inhabitants were at the center of sociopolitical, economic, and religious interaction of the surrounding district. Its complex network of long distance roads connecting to surrounding sites displays social stratification (Vázquez Leiva et al. 2003:150). Cubujuquí, located just to the west of the Puerto Viejo River, is a large architectural complex with mounds, foundations, walls, and causeways (Gutiérrez González and Mora Sierra 1988:105). The occupation of this site initiated around A.D. 1000 and was relatively short and

intense since its inhabitants abandoned the settlement at least two centuries before the Spanish conquest. I will start by describing the landscapes of movement at Cutris.

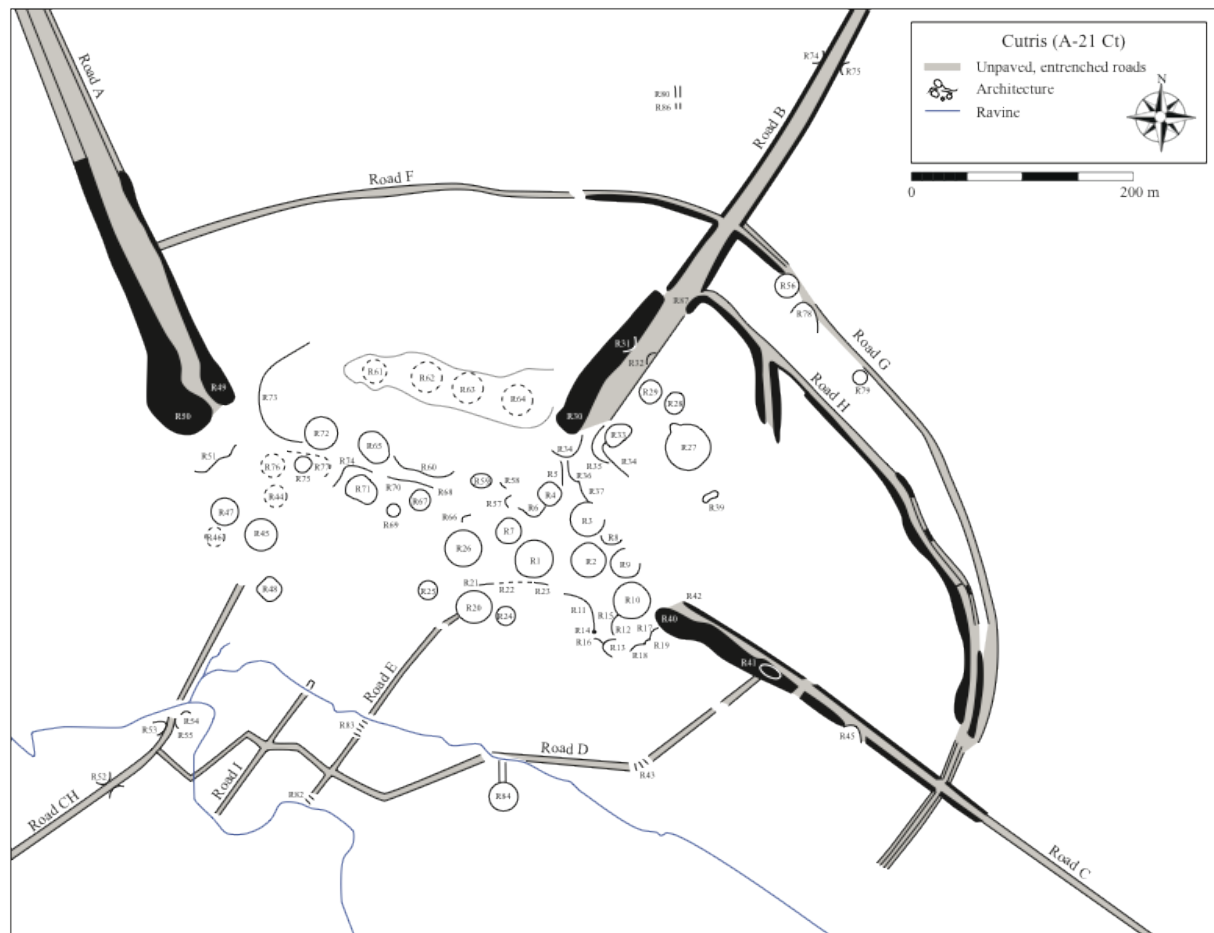


Figure 8. This site plan of Cutris shows the relationship of roads with other architectural features (redrawn after Sheets 2009:173; Vázquez Leiva et al. 2003:155).

Cutris (A-21 Ct) (Figures 8 and 9) has a long-distance sunken road network that connects with four other sites: Montealegre (A-92 Mn), Veracruz (A-91 Vc), Crucero (A-93 Cr), and Concepción (A-94 Cn) (Vázquez Leiva et al. 2003). This network includes four main roads (A, B, C, and Ch) coming from all directions outwards from Cutris toward the smaller villages. All four roads act as channels of inter-village communication varying in size and appearance (Vázquez Leiva et al. 2003:159) with widths between four and seven meters (Troyo Vargas and

Guerrero Miranda 1998:86). In addition, roads A, B and C widen to form impressive embankments, 40 meters in width, to mark arrival at the site (Vázquez Leiva et al. 2003:161). These embankments begin 500 meters before reaching the architectural center of Cutris (Trovo Vargas and Guerrero Miranda 1998:86). The roads within the village (D, E, F, G, H and I), although small in width, are visible as linear depressions in the ground measuring between two and three meters wide. The curvilinear paths F, G, and H connect to the main roads (Vázquez Leiva et al. 2003:162). Other roads (D, E and I) gave access to water or other primary resources (Trovo Vargas and Guerrero Miranda 1998:86). These roads have staircases made of boulders ascending to streams (Vázquez Leiva et al. 2003:162). Also, some of the secondary roads connect walled structures and cemeteries (Trovo Vargas and Guerrero Miranda 1998:86).

The construction methods for the roads at Cutris are distinct from all other architecturally complex sites with road works (Vázquez Leiva et al. 2003:150). In general, formalized roads elsewhere in the Central American Isthmus are paved with river cobbles, being built either on mounded earth or on the surface. However, at Cutris, the earth was carefully excavated and brought upward to construct linear sunken roads (Trovo Vargas and Guerrero Miranda 1998:86). These roads were intentionally constructed, in contrast to the footpaths in the Arenal region formed through erosion as a result of repeated human use (Vázquez Leiva et al. 2003:159). The high annual rainfall combined with the absence of paving stones and drainage for rainwater accumulated in sunken roads could have done considerable damage to the integrity of these earthen structures (Vázquez Leiva et al. 2003:162). However, preliminary analyses of the roads did not show significant evidence of erosion. In short, the road works from Cutris are impressive in both their method of construction and their distance (Vázquez Leiva et al. 2003:171). This

network of roads communicated with other villages, streams (water sources), cemeteries, and primary resources.

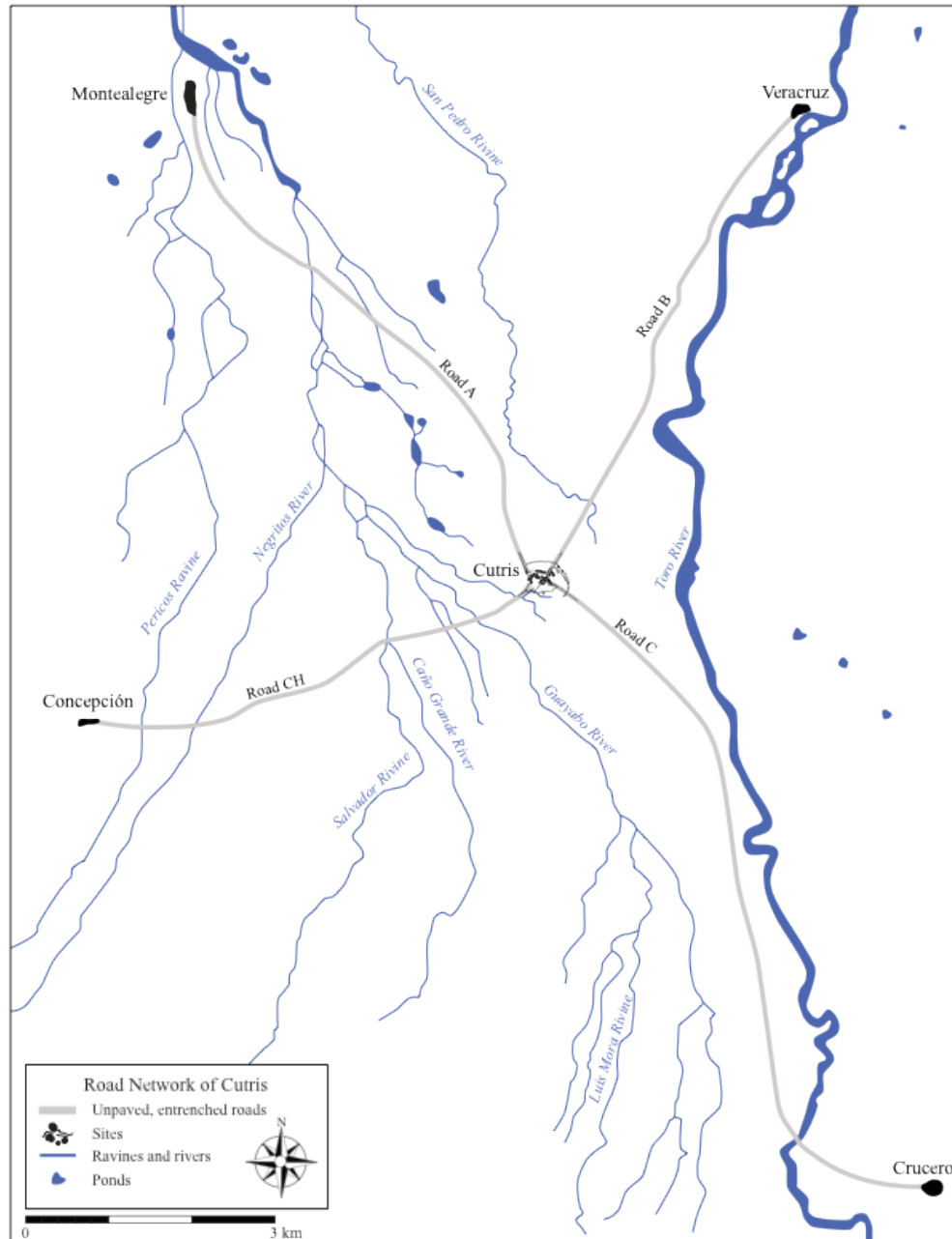


Figure 9. Cutris (A-21 Ct) was connected to at least four other habitation sites: Montealegre (A-92 Mn), Veracruz (A-91 Vr), Crucero (A-93 Cr), and Concepción (A-94 Cn) (redrawn after Vázquez Leiva et al. 2003:160).

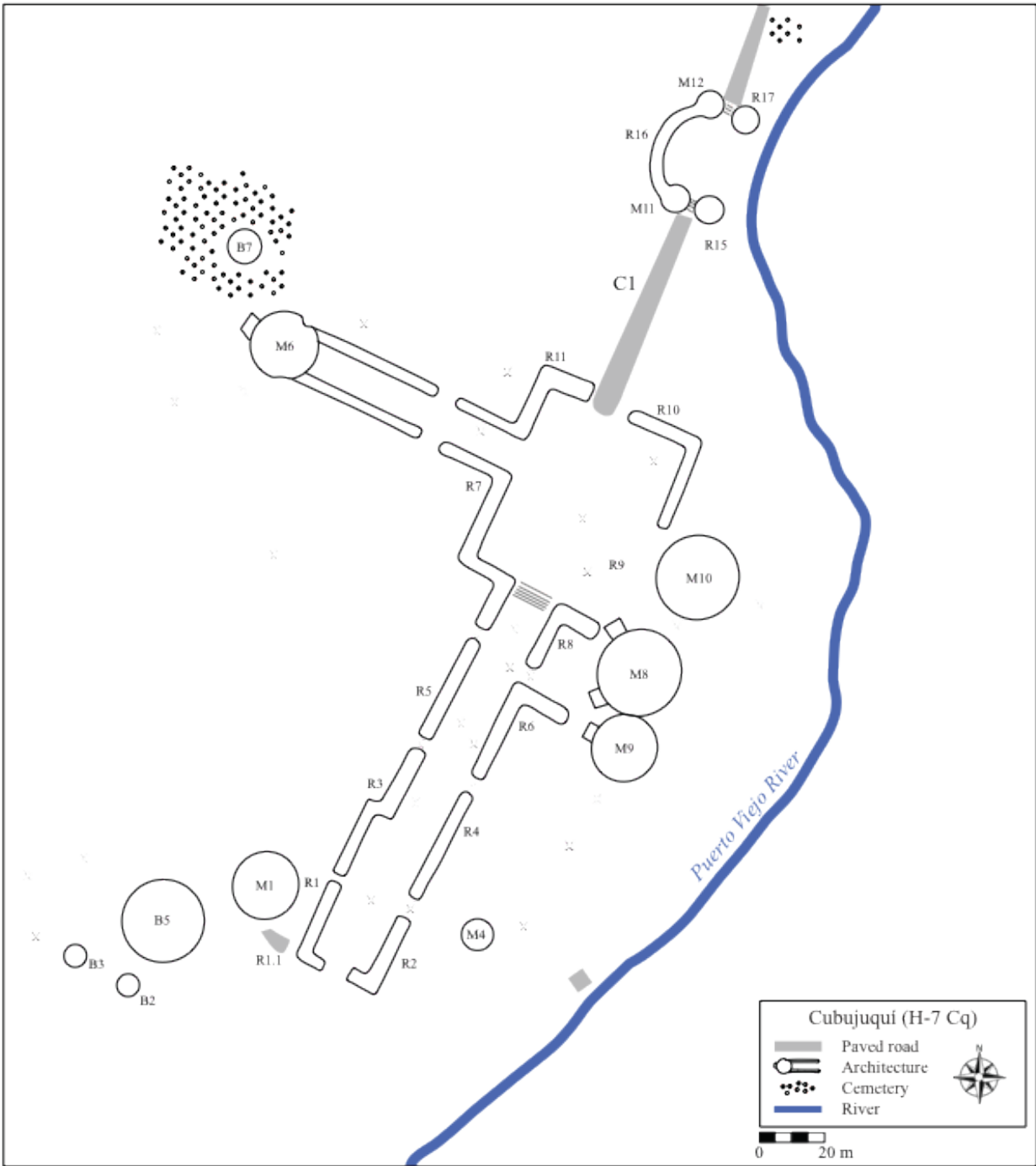


Figure 10. This map displays the architectural features at Cubujuquí (redrawn by Antoinette C. Egitto after Gutiérrez González and Mora Sierra 1988:113).

Cubujuquí (Figure 10) has two documented road features. Causeway 1 (C1) extends 65 meters north from the 55 by 45 meter “plaza.” At its start, between R10 and R11, C1 has a width of 15 meters, but its width diminishes a few meters by the time it reaches M11 and R15 (Gutiérrez González and Mora Sierra 1988:108). At that point, C1 ends momentarily before continuing for another 60 meters. In all, C1 extends northward about 1.5 kilometers. A second paved half circle paved path (R1.1) is located between R1 and M1, which is 22.5 meters long and three meters wide (Gutiérrez González and Mora Sierra 1988:109). This smaller path, being connected to R1, is then connected to the walled corridor made of similar “wall” features that leads northward to the walled plaza and eventually to C1. The existence of these causeways and other monumental features further suggests a strong political presence to have mandated such impressive, labor-intensive constructions. Furthermore, the “plaza” might have been used as a market or as ceremonial center, to which a paved road provides access from the outside and from which all other parts of the site are connected via corridors.

The Reventazón Subregion

The Reventazón Subregion is primarily defined by the Reventazón-Parismina hydrographic drainage basin, stretching from the highlands to the Caribbean Coast. Exactly where the subregion is delimited is not clear. While by no means the first archaeological research in this subregion, Kennedy’s (1968, 1976) dissertation research was the first regional archaeological survey to be conducted in the Reventazón Subregion. Since Kennedy’s research, archaeological investigations by Snarskis (1978), Sánchez (1987), a team of archaeologists led by Vázquez (2002), and others have been conducted in the Reventazón Subregion, building on our understanding. Kennedy (1968, 1976) documented a large number of archaeological sites in the Reventazón River Valley, most of which provided evidence for a pattern of settlements that

were primarily small villages and hamlets and dispersed across the landscape, ranging in ages from about 300 B.C. to around A.D. 1400. Most of the sites investigated during this survey temporally placed between A.D. 400 and A.D. 1400, indicating an increase in population at this time. Kennedy noted the appearance of more cultural material from other subareas during this period, indicating increased networks of communication, interaction, and exchange.

The most studied archaeological site in this subregion is Monumento Nacional Guayabo¹⁵ (C-362 MNG), with research ranging in time from as early as the late 1800s by Polakowsky (1890) to a recent critical analysis of the archaeological research of the past century (Murillo Herrera 2002). The Reventazón Valley served as one of the major arteries of interaction and exchange between populations. Guayabo (Figure 11), located on the southern slope of Turrialba Volcano near the Reventazón Valley between the Guayabo and Lajas rivers, is the most well-known and best-studied site in this subregion, if not all of Costa Rica. Guayabo was occupied from 200 B.C. to A.D. 1300 spanning parts of Periods IV, V, and VI. During Period VI, the Turrialba/Reventazón Valley served as the principal interaction and exchange route between the Guarco and Suerre populations. Travelers along this route had to cross through Guayabo territory, and this may have had an effect on the importance of the site. (Trovo Vargas 2002:61). This is likely the same route taken by Benzoni (1970 [1578]:126-134) when traveling toward the Central Highlands from Suerre in 1544 with Governor Diego Gutierrez.

Guayabo (Figure 11) has at least two cobble-paved roadways known as the Caragra Road and the Paloma Road (Vázquez Leiva et al. 2002). The Paloma Road starts to the northeast of the architectonic center of the site and has been followed for about 4.3 kilometers (Vázquez Leiva et

¹⁵ This site is commonly referred to as Guayabo or Guayabo de Turrialba. Hereafter, I refer to this site as Guayabo.

al. 2002:316). This road eventually leads to a petroglyph and beyond to several other sites, having been followed as far as Paloma-1 (C-398 Po-1).

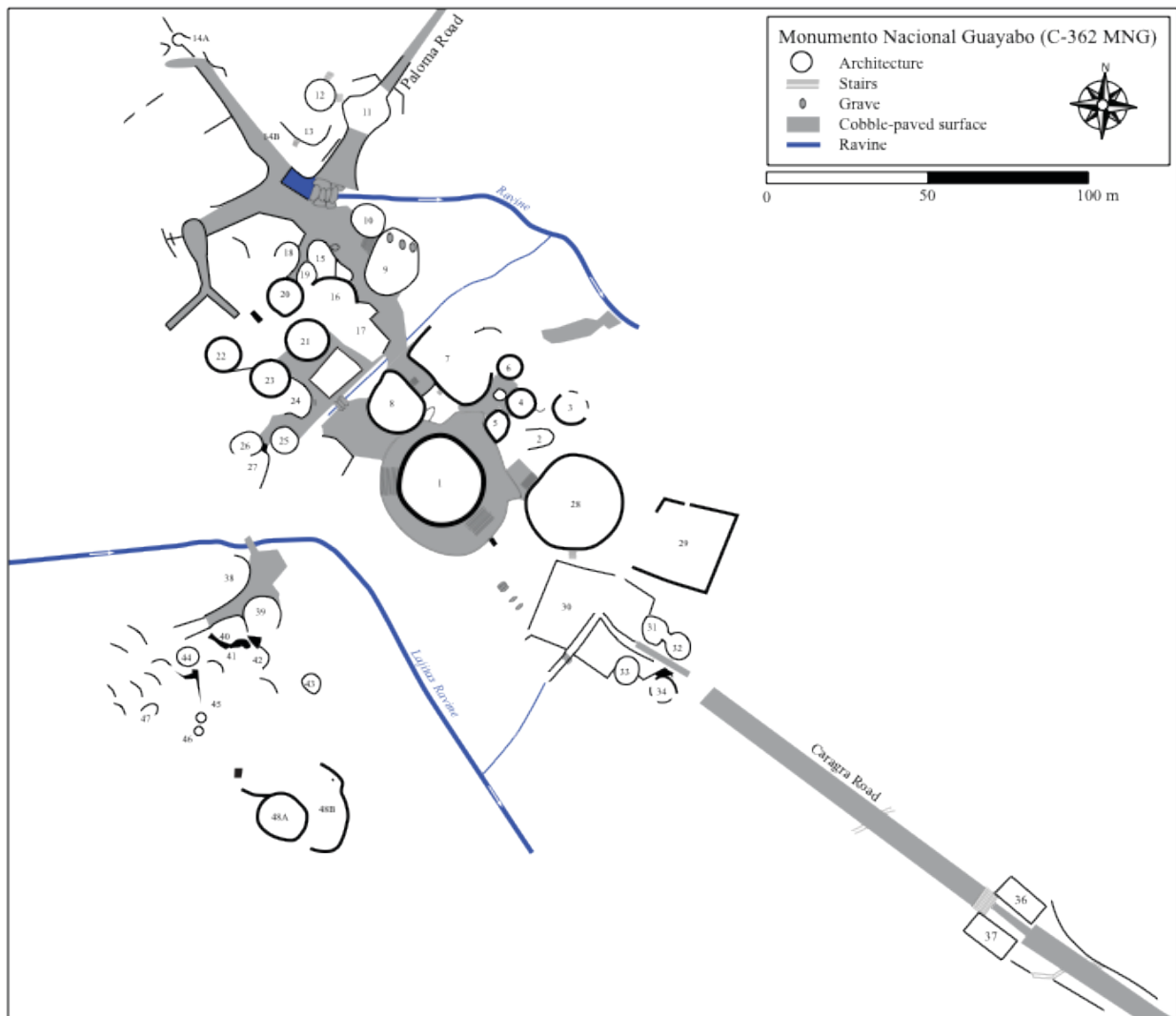


Figure 11. Site plan of Monumento Nacional Guayabo (C-362 MNG) (redrawn after Aguilar Piedra 1972:Lámina 22; Fonseca Zamora 1981:105; Troyo Vargas and Garnier Zamora 2002:figures 13, 15, 16, 19, 27; pages 98, 102).

The Caragra Road arrives at Guayabo from the northwest with an entrance to the site marked by two symmetrical rectangular structures with a set of stairs that lead up to an elevated 6.5 meter wide portion of the road (Troyo Vargas 2002:97) that is a little over 65 meters long

(Vázquez Leiva et al. 2002:316), and from there the road leads toward Mound 1. The paved path between the rectangular structures at the entrance to the site is the narrowest section of the route, measuring one meter in width and 16 meters long. The two principal mounds, Mound 1 and Mound 28, are built near the northwest extent of the Caragra Road, although it does not connect to them. Excavations have shown that at the northwest extent of the road, the path is bordered by four mounds, two on each side (Troyo Vargas 2002:100). Past this point, a footpath may have led to the principal mound (Mound 1) from the Caragra Road, where a set of stairs descend to the level of the road (Troyo Vargas 2002:66). The Mound 1 is encompassed by a circular paved walkway that is connected to an internal road to the north northwest that eventually becomes the Paloma Road (Troyo Vargas 2002:67).

The Caragra Road has been documented to connect Guayabo with other sites somewhere within the forested zone to the southeast (Figure 12). These sites include Guayabo-4 (C-286 Gy-4), Iyök (C-287 Ik), Isigo (C-288 Is), Cusquerre (C-273 Cq), and Nájera (C-8 Nj). At Najera, the Caragra Road comes to an end and another, the Alto Varas Road, extends to the SW leading to the sites of Danta (C-272 Dn), Zanjones (C-271 Zn), and La Zoila (C-5 LZ) (Vázquez Leiva et al. 2002:318). Representing a huge amount of human labor, the 5.4 kilometer long Caragra Road (Vázquez Leiva et al. 2002:318) was built with some hundreds of thousands of river cobbles, each between 40 and 90 centimeters in diameter, cumulatively weighing somewhere around 10,000 tons (Troyo Vargas 2002:51).

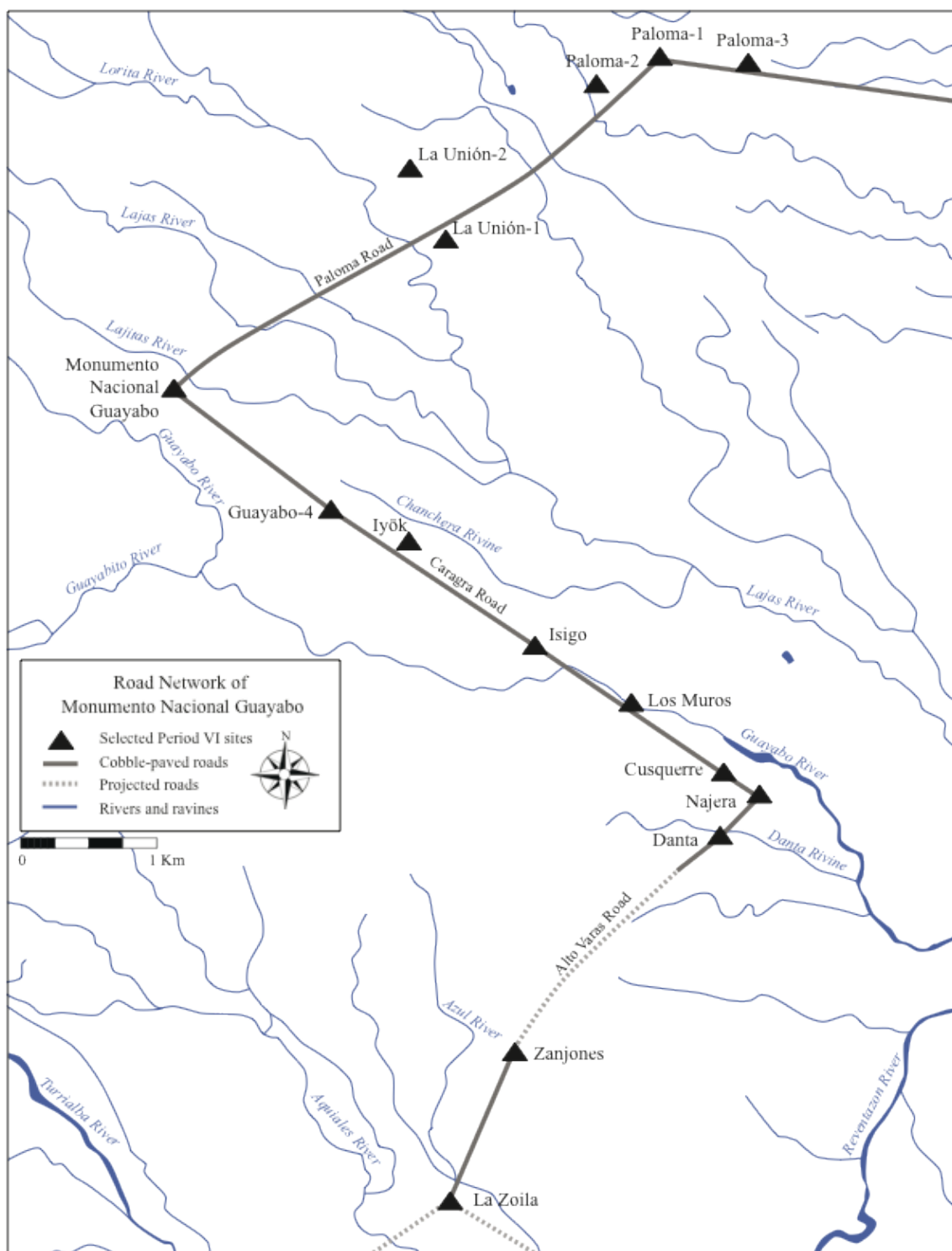


Figure 12. This map shows the known extent of the roads associated with Monumento Nacional Guayabo (C-362 MNG) and connected sites (redrawn after Vázquez Leiva et al. 2002:319).

Similar to the Arenal Project, researchers have used remote sensing techniques to detect and map the roads in the region around Guayabo, but the information remains unpublished (Maureen Sánchez, personal communication 2008). The only published image from this research can be found in the March 17, 2005 edition of the *La Nación* newspaper (Arce 2005). This comes as evidence that the same remote sensing methodological techniques can be used in other regions to detect archaeological features, including traces of landscapes of movement.

The documented landscapes of movement in the Reventazón Subregion are centered on Guayabo, which is the most renowned and best-studied archaeological site in Costa Rica. However, Kennedy (1968:24) reported stone-paved walkways passing the Period VI site Section 2-B (C-24). These roads were likely connected to the landscapes of movement that passed through Agua Caliente and other sites in the Central Highlands. Furthermore, some extension of the Paloma Road might have connected Guayabo to Las Mercedes-1 in the Línea Vieja Subregion.

The Línea Vieja Subregion

The archaeology of this subregion is shadowed by its historical importance as the location of the first railroad line in Costa Rica and the development of the United Fruit Company. The name *Línea Vieja* refers to this first railroad that connected Puerto Limon on the Caribbean Coast to San José, the capital city of Costa Rica. This railroad was constructed along the eastern skirt of the Cordillera Central, an area that marks the beginnings of the Caribbean lowland plains (Snarskis 1976a:101).

While the Línea Vieja eventually fell out of use for transportation to and from the Central Highlands, Minor Cooper Keith continued to utilize the tracks the government had paid him to construct. Part of his payment was the land surrounding the tracks, which he cleared and

transformed into the first banana plantations of the United Fruit Company. During the construction of the railroad and cultivation of banana, Keith and his employees uncovered and unearthed the ruins of many abandoned indigenous settlements. Since the more recent components of the archaeological sites in the Línea Vieja are contained within the thick highly organic topsoil of the region, ceramic sherds, lithics, and whole artifacts appeared everywhere as Keith's workers cleared the vegetation. They looted many tombs and removed many thousands of artifacts from the contexts they were deposited or discarded. Accompanying Keith's treasure collecting, he also facilitated the first archaeological excavations in the sub-region in 1896.

Swedish botanist and anthropologist Carl Vilhelm Hartman (1901) conducted excavations at the site of Las Mercedes (now identified as L-289 LM-1)—located on a farm owned by Keith—in 1896, an investigation that marked the beginning of scientific archaeology in Costa Rica. Although he did not conduct stratigraphically controlled excavations, Hartman did describe his methods, actions, and discoveries in a way that helps others learn from his findings. Further investigations at Las Mercedes as well as the Anita Grande (L-53 AG) and Costa Rica Farm sites in the Línea Vieja Subregion were conducted by Alanson Skinner (1926) during the winter of 1916-1917. Despite this extensive research, the data he collected was only published in note form. Doris Stone (1966) and Matthew Stirling (1969; Stirling and Stirling Pugh 1997) also conducted archaeological investigations in this subregion.

Snarskis (1975, 1976a, b) conducted archaeological excavations near the modern settlements of Guápiles and Guácimo beginning in 1973 that formed the foundation of our current state of understanding of the archaeology of the subregion and the rest of the Caribbean lowlands. He excavated at Severo Ledesma (L-7 SL), Finca Numancia (L-40 FN), Finca Patricia (L-41 FP), La Cabaña (L-20 LC), and MOPT (L-21 MOPT). Around A.D. 900 – 1000, the

architectural plans of settlements in the Caribbean lowlands became more centralized, with small circular houses surrounding a grouping of large cobble-wall-sided earthen mound, which housed high-ranking individuals. In these sites, cobble-paved causeways extended outward from the central mounds and the plaza-like spaces (Snarskis 1978:282). Among the sites where road and path features are documented include: Williamsburg (L-58 Wb), Las Mercedes-1 (L-289 LM-1), La Cabaña (L-20 LC), Anita Grande (L-53 AG), Cairo (L-77 Cr), Finca Numancia (L-40 FN), La Iberia (L-4 LI), La Alegría (L-126 LA), Las Flores (L-143 LF) (Vázquez Leiva 2006b), and Nuevo Corinto (L-72 NC). Here I will summarize our current knowledge of the roads and paths at a few of these sites.

Williamsburg (L-58 Wb) (Figure 13), occupied during Period V (A.D. 500 – 1000) and Period VI (A.D. 1000 – 1550) (Corrales Ulloa and González 1986:30), is located about 11 kilometers northeast from the town of Siquirres, extending along Williamsburg (or Estrella) Ravine and between the Línea Vieja railway and the old highway to Guácimo (Corrales Ulloa and González 1986:21). The site contains a group of ten mounds and circular foundations, an internal causeway, and a funeral zone 500 meters to the north (Corrales Ulloa and González 1986:22). The internal cobble-paved causeway is 59 meters long and four meters wide. It extends lengthwise, connecting Mound 2 (M2) and Mound 5 (M5) to each other (Corrales Ulloa and González 1986:25). Mounds 1 (M1) and 3 (M3) are also associated with the causeway by way of small ramps, which descend into the causeway from either side of it (Corrales Ulloa and González 1986:27). Williamsburg, like other contemporary complex sites of the Caribbean Lowlands, contains circular mounds, circular foundations, adjacent cemeteries, and at least one causeway. Williamsburg may have been connected to one or more of its neighboring, architectonically complex sites.

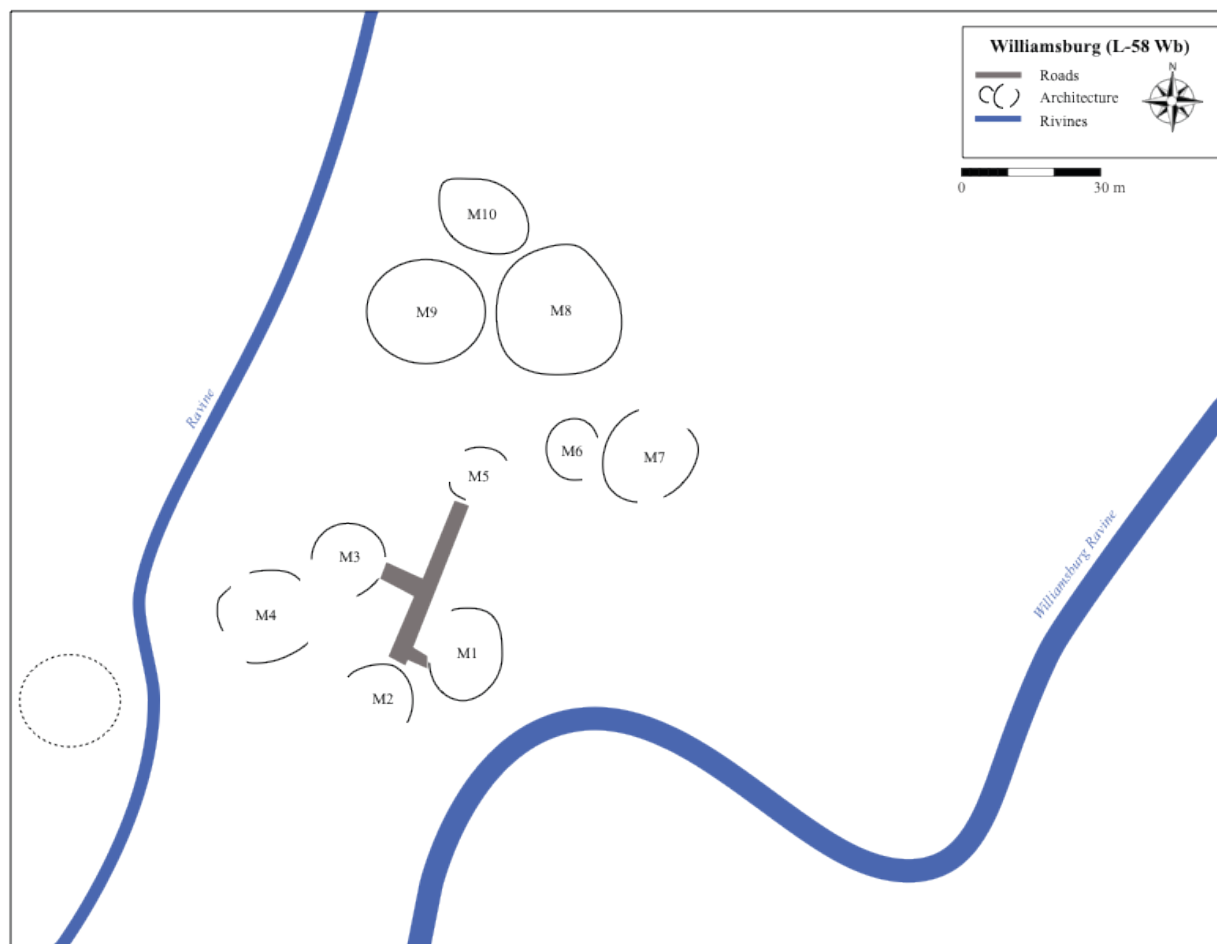


Figure 13. This site plan of Williamsburg (L-58 Wb) shows the relationship of the internal causeway with the surrounding mounds (redrawn after Corrales Ulloa and González 1986:Figure 3; Departamento de Antropología e Historia del Museo Nacional de Costa Rica (DAH-MNCR) 2012).

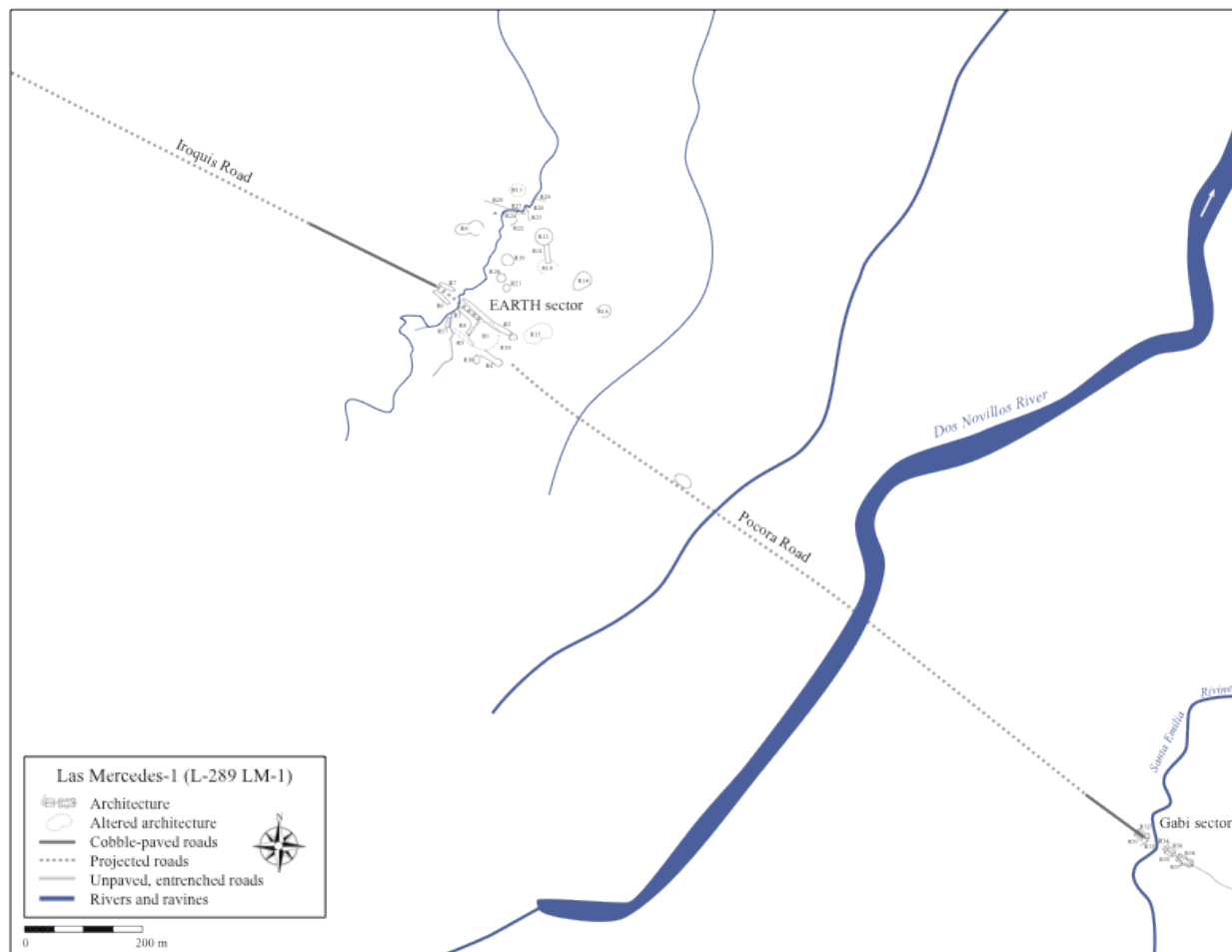


Figure 14. Map of Las Mercedes-1 and the associated roads (Pocora and Iroquois) (Vázquez Leiva 2006b:66) (redrawn after Vázquez Leiva and Chapdelaine 2008:Figures 2, 3, 4).

Las Mercedes-1 (L-289 LM-1) (Figure 14), which was the center of a powerful polity in the Línea Vieja Subregion of Costa Rica around A.D. 1000, is located about 90 meters above sea level between Dos Novillos River (700 meters southeast) and Parismina River (2.5 kilometers northeast) (Vázquez Leiva and Chapdelaine 2008:29). This site is the home of two well-documented stone-paved roads, named Iroquois and Pocora for the present-day towns they lead toward from the main architectural complex of the site. With widths ranging between five and eight meters, they follow a northwest to southeast path (Vázquez Leiva and Chapdelaine

2008:37), running perpendicular to the river drainage system (Vázquez Leiva and Chapdelaine 2008:27).

Pocora Road begins in the main complex and extends for an indefinite distance, going beyond the zone southeast of the complex (Figure 14), where the vegetation was not cleared during the 2005 field season. Pocora Road continues for more than 300 meters, running parallel to a secondary road, which connects to the Dos Novillos River. This road surface was raised above the surrounding landscape as a protective measure against flooding. When Pocora Road reaches its southeast extent, it ends, intersecting with a small stream known as Santa Emilia (Figure 14). Just before it reaches the stream, Pocora Road is flanked by an architectural complex consisting of two low walls with circular halves on the southeast side (R31 & R32), resembling those of the main complex (Vázquez Leiva and Chapdelaine 2008:41). A set of stairs (R33) between the circular structures, descends to the stream (Vázquez Leiva and Chapdelaine 2008:42).

A suspension bridge may have crossed the Santa Emilia Stream, connecting the two roads and the two architectural complexes. Such suspension bridges may have once crossed the channels of the Dos Novillos and Iroquois rivers, too. Vázquez and his colleagues think this road network included a stone drainage system to reduce the erosional effects of water flowing across the road surfaces. However, these features have not been identified (Vázquez Leiva and Chapdelaine 2008:64). Near the Santa Emilia Stream, a footpath three meters wide was defined by a linear depression in the land's surface. This unnamed footpath extends in the same general direction as the road and has been followed 150 meters. However, it seems to disappear about 400 meters before reaching Destierro River (Vázquez Leiva and Chapdelaine 2008:43).

The research to date has recorded much data about the Pocora Road, whereas our knowledge of Iroquois Road will never be complete due to its alteration and partial destruction over the years. Straight and stone-paved, Iroquois Road has been followed for about 660 meters at the edge of the EARTH University reserve that contains the site. However, researchers predict that it extended as far as the modern town of Iroquois (Vázquez Leiva and Chapdelaine 2008:37). Although Iroquois Road has not been followed in its totality, one may presume that it is of a comparable length to Pocora Road, based on their similarity in design (Vázquez Leiva and Chapdelaine 2008:65).

Both the Iroquois and Pocora roads are interpreted to have offered formalized, controlled, and ceremonial access to the central part of the Las Mercedes-1 architectural complex. The roads go in opposite directions from the center of the site along a route perpendicular to the hydrographic system and parallel to both the modern highway and railroad. In fact, it appears as if these roads are part of a longer route that passed through many sites in the Línea Vieja Subregion.

Pocora Road does not directly communicate with another archaeological site but aims toward Williamsburg some 3.5 kilometers to the southeast of Las Mercedes-1. While the Road ends 1.5 kilometers before reaching Williamsburg, an archaeologically identified footpath may extend the rest of the way connecting these sites (Vázquez Leiva and Chapdelaine 2008:64). With these roads as part of one extensive construction project sharing the same constructive techniques, the maintenance cost of the roads of Las Mercedes-1 must have been great for the former inhabitants of the district around the Las Mercedes sites. A large workforce would have been required to prepare the terrain and transport the stone, fill, and other construction materials (Vázquez Leiva and Chapdelaine 2008:65). Like Guayabo and Cutris, a lot of labor would have

been needed to construct and maintain the road surfaces leading into the supposed sociopolitical center. The ability to command such labor force, could be interpreted as representing chiefly authority and the mentality of monumentality evoked from social memory.

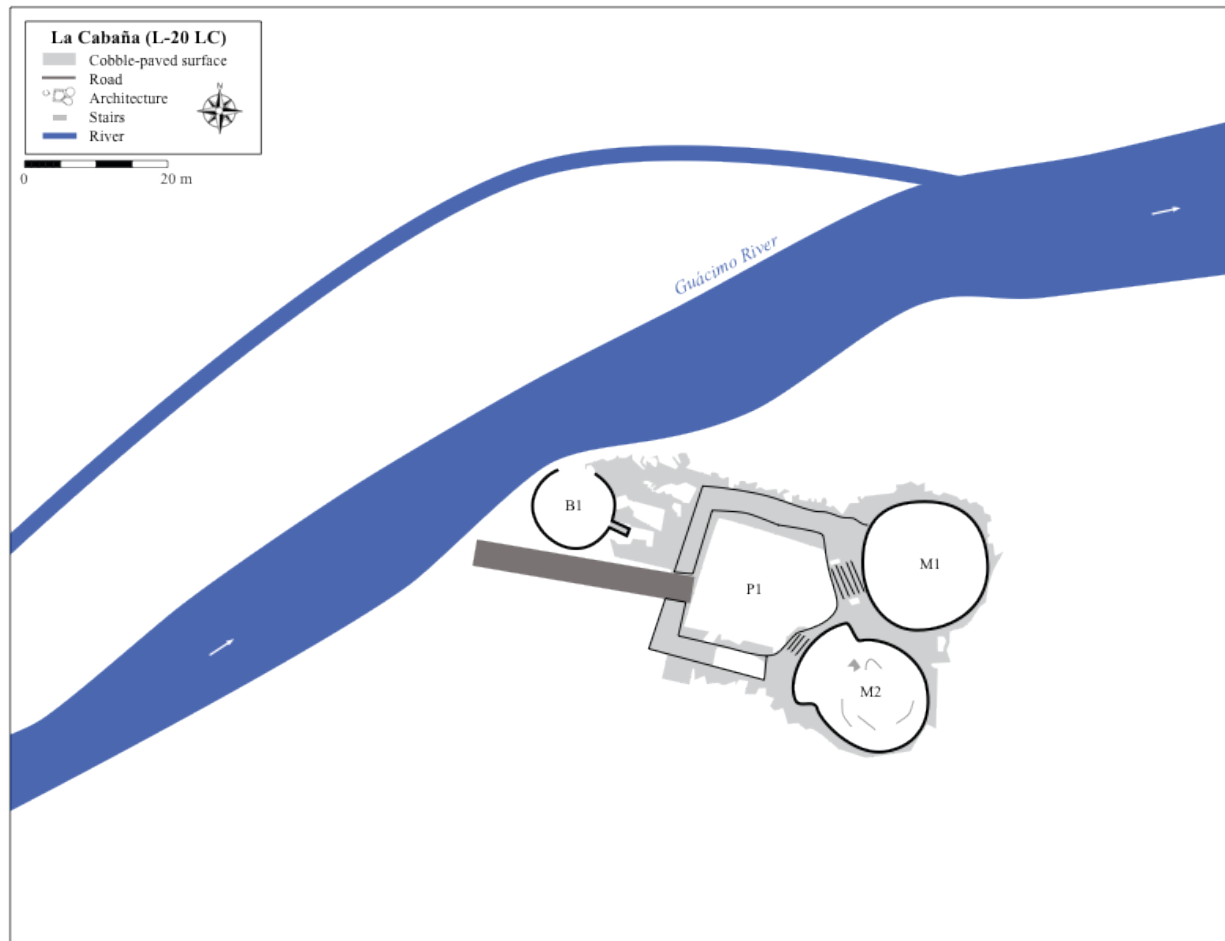


Figure 15. This site plan of La Cabaña (L-20 LC) shows the relationship of the road in relationship to mapped features (redrawn after Departamento de Antropología e Historia del Museo Nacional de Costa Rica (DAH-MNCR) 2012; Snarskis 1984:Figure 8).

La Cabaña (L-20 CB) (Figure 15), located 1.5 kilometers west of Guacimo (Snarskis 1978:242), has stairways descending from the site's two major mounds into a plaza where three cobble-paved causeways enter from surrounding sections of the site. The plaza has been

interpreted as the location for the ritual redistribution of goods (Snarskis 1978:282). This ceremonial center and its contemporary living spaces date to Period VI (Snarskis 1978:45-46). The western causeway extended outward almost to the edge of a 15 meter bluff next to the Guacimo River (Snarskis 1978:249). This route may have provided access to the river for drinking water and/or transportation at a time when the bluff was less profound.

Snarskis (1978) also took good note of the constructive techniques of these paved roads/causeways, which shed light on their production throughout the Central Region.

The construction of the cobble-paved street leading into the empty plaza was accomplished by first sinking two rows of large flat stones, set on edge, along the edges of the feature at the desired width. Flat cobbles were then laid in rows along the length of the street, the first two rows along the sides being placed partially on top of the border stones set on edge. Later, as the stones forming the bulk of the street gradually settled, two rows nearest the edge were left tilted downward toward the center of the street. The stones placed on the edge did not settle as much, probably having been packed in firmly during construction. This phenomenon may explain why cobble-paved streets of Guayabo de Turrialba are today as much as 30 cm or more below their border walls: they probably rested on artificial fill which was more susceptible to compacting (Snarskis 1978:255).

While not all of the formalized roads in Costa Rica were constructed in this way, similar techniques may have been used in surrounding sites and this detailed description will prove useful in further analyses of formalized road construction techniques. The causeways at La Cabaña, where artificial fill and stone construction required substantial organized labor, are not the only terrestrial routes recorded at this site. Also, a little cobble path was noted to have led

away from Tomb 1 in the La Cabaña cemetery (Snarskis 1978:286), showing how even in the same site different techniques were utilized in road formalization.

Here I have only summarized our knowledge of a few landscapes of movement in the Línea Vieja Subregion. For a more comprehensive description of the road and path features of this region, one should turn to the report “Planimetrías de varios sitios arqueológicos con arquitectura y obras viales de la zona de Línea Vieja, Caribe Central de Costa Rica” by Vázquez Leiva (2006b). He describes the features I described above and several more, including the 1.4-kilometer distance of the Parasal Road and Edén Road at Anita Grande (L-53 AG; including Costa Rica Farm). In the next section, I will refer to this road and to the others I have described as I attempt to discern networks of movement in the Central Region.

Discerning Networks of Movement in the Central Region

Roads and trails connected sites all over the Central Region. In some districts we know much more about intersite connectivity, because archaeologists, most notably Ricardo Vázquez Leiva, have diligently traced and mapped those roads to reveal how they were connected to surrounding settlements, cemeteries, and other localities. However, in most cases we can only speculate where short roads led after leaving the architectural centers of the sites from which they originate. This is the case with La Cabaña and Williamsburg. While it is possible that Williamsburg is connected to the Pocora Road from Las Mercedes-1, we not yet have absolute evidence of this connection. Furthermore, given the northern direction of one road at Iberia, it is likely Williamsburg and Iberia were connected, as well. By mapping out these features as Vázquez has done (see Figure 16), we are able to discern how unmapped portions of landscapes of movement might have interconnected all or most settlements in the region into networks of movement. The most extensively documented landscapes of movement are those associated with

Cutris, Guayabo, Las Mercedes, and Anita Grande. This thesis sets out to add Nuevo Corinto to this list. These sections of the network of movement are known because research efforts have revealed them.

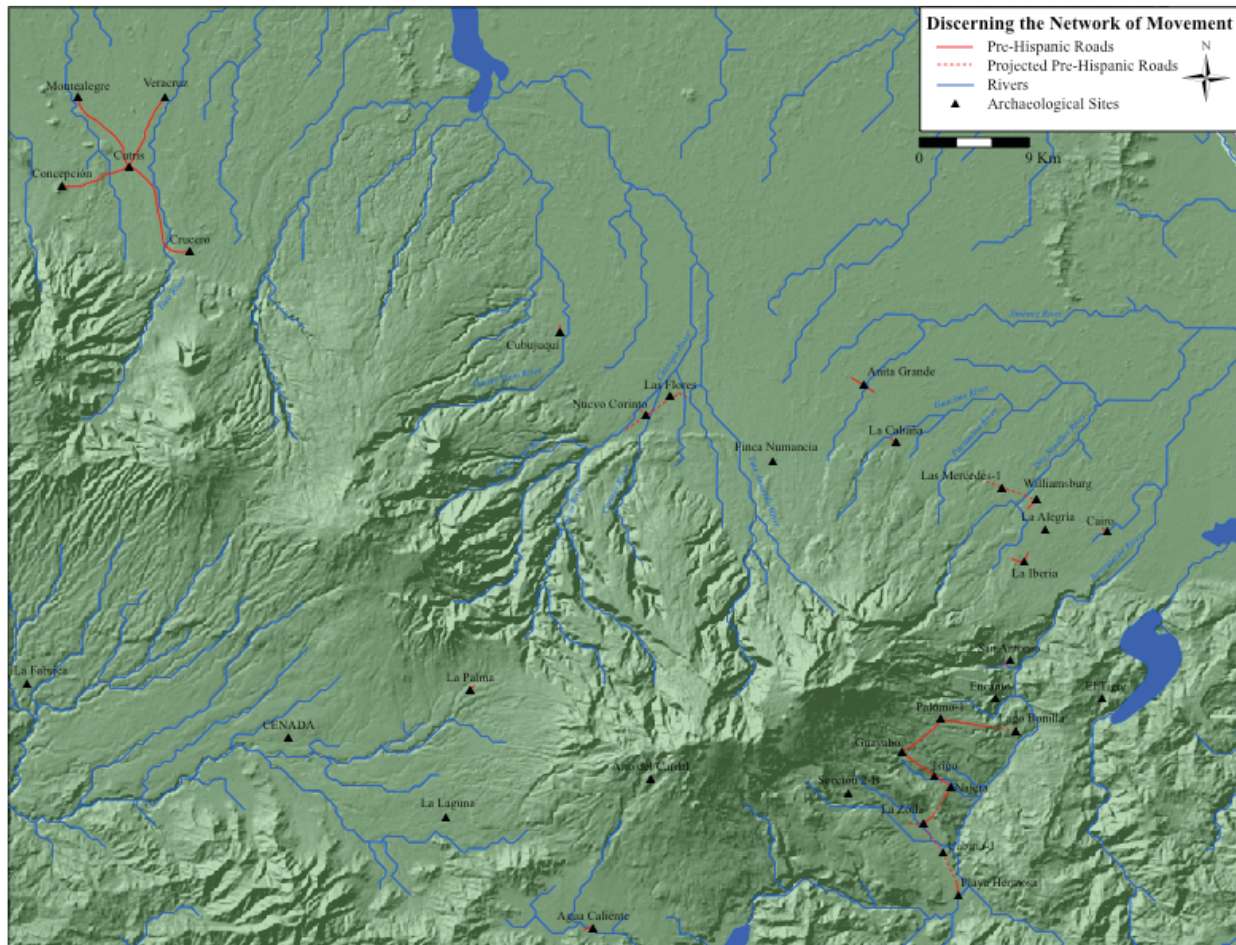


Figure 16. This map shows the mapped sections of roads and how they are related to other sites in the Reventazón and Línea Vieja subregions as well as Cubujuquí in the Northern Slope Subregion (modified and redrawn after Vázquez Leiva 2006b:Figure 1; Vázquez Leiva et al. 2003:160).

If we conduct more research in the sectors of the region we know less about, we might be able to produce a more comprehensive understanding of the sociopolitical organization of these

people. However, the possibility remains that we will never be able to reveal enough of the actual network of movement to discern the sociopolitical organization of the Central Region and how it evolved over time. Nevertheless, the subject merits much attention and research effort.

The quantity of effort given to understanding the landscapes of movement in the Caribbean Lowlands needs to be shared with the Central Highlands. In the later subregion we know little about how settlements were interconnected during pre-Hispanic times. Peytrequín Gómez (2009:43) notes that other pre-Hispanic cobblestone-paved roads located to the east of Agua Caliente, might have served as routes of communication connecting neighboring chiefdoms. He goes on to say that other sites of comparable size and importance to Agua Caliente in the Caribbean Lowland plains and the Turrialba Valley (as we have seen here) were linked to neighboring sites by roads, revealing local and political spheres of influence. While urbanization and other land use changes and resultant landscape modifications have made it impossible to follow the Agua Caliente's landscapes of movement outward, the possibility that these features led to neighboring villages cannot be excluded (2009:43). The inhabitants of Agua Caliente interacted and exchanged goods and information greater distances than to their neighboring small villages and hamlets, the difficulty is describing the routes they used when the exact landscapes of movement are no longer intact or visible.

The same carries true when interpreting the landscapes of movement documented at sites in other areas where land use changes and geologic processes have altered the landscape so much that we will never know exactly where the roads led. One way we can mitigate the limits in our knowledge is through optimal predictions of where people would have moved across a terrain between points when the concrete evidence is no longer available. These least cost paths (LCPs) and least cost corridors (LCCs) can be produced using geographic information systems (GIS). I

use this method where I am not able to see interdistrict landscapes of movement from Nuevo Corinto. However, the same method may be applied to questions of intersettlement communication if a high enough resolution of data is available.

When we add in the waterscapes of movement, we will be able to see a significantly larger portion of the network of movement. So far, we do not know how much of the hydrographic network was navigable in the Central Region. I speculate that many of the rivers in the Caribbean Lowlands were navigable by canoes throughout the year, at least downstream. The documented landscapes of movement throughout this region connected to many streams and rivers since they almost all run perpendicular to the fluvial network. What if some of these intersections between landscapes of movement and rivers represents the beginnings of waterscapes of movement (i.e., points where the velocity and depth of rivers are conducive to canoe travel)? We need to ask questions similar to that if we are to discern the networks of interaction and exchange across the entire region and beyond.

However the inhabitants of the Caribbean Lowlands reached the Central Highlands, doing so gave them access to the Central Pacific Coast through the natural passes of the rivers Jesús María and Tárcoles. This interregional route would have facilitated the movement of goods and information from the Pacific Ocean and Gulf of Nicoya to and from the Caribbean Sea. The network of movement that routes like these were a part of explain why the Central Region, a region consisting of many chiefdoms or complex-tribes, was characterized by such expansive cultural continuity during the later periods of the pre-Hispanic Era. To understand more about this network of movement, I use the recent findings at the sites of Nuevo Corinto and Las Flores in the La Unión District of the Línea Vieja Subregion. First, I must define exactly what I mean by the La Unión District.

Nuevo Corinto and the Archaeological Landscape of the La Unión District

Archaeological Districts

Density of archaeological sites in some portions of Costa Rica brings into question the utility of the liberal use of the term ‘site.’ Every time a new archaeological discovery is made and reported to MNCR, the location of these findings is given a site number. The density of reported archaeological sites is then reflective of the survey constraints of property lines, rivers, and the ability to associate new findings with formerly registered archaeological sites. Rather than reassess the ‘site’ status of reported findings in the museum’s registry, discussing these sites within the slightly larger spatial categories of locality and district can address this definition of “site” and facilitate off-site comparative analyses essential to a landscape archaeology perspective. As defined by Willey and Phillips (1958:18) a site is “the smallest unit of space dealt with by the archaeologist and most difficult to define. Its physical limits... may vary.” They define a locality “as a slightly larger spatial unit, varying in size from a single site to a *district* of uncertain dimensions; it is generally not larger than the space that might be occupied by a single community or local group” emphasis (ibid.; emphasis added). The concept of an archaeological district is an old one but one that has not received much use. Locality, as Willey and Phillips define it, includes both sites and districts of sites. An archaeological district is then a locality consisting of several sites that make up a single community. Analyzing districts rather than sites will allow archaeologists to take an off-site perspective on landscape use, while attempting to use a slightly more emic analytical spatial reference. Many neighboring ‘sites’ were likely interrelated to one another in the late pre-Hispanic Period of the Isthmo-Colombian Area, and using the district as the analytical unit captures this reality. Archaeologists researching in this area still have a long ways to go to understand inter-site relationships. I believe that

decreasing the scale of spatial analysis (that is, backing away from site specific analyses) will assist in realizing this goal.

Defining the La Unión District of the Línea Vieja Subregion

The surroundings of the modern day settlement of La Unión contain archaeological deposits that date to early Period IV (1000-500 B.C.) and continue to present. The La Unión District can be roughly geo-spatially defined by the alluvial landmass between the eastern slope of the Cordillera Central and the Torro Amarillo River, North of the Cordillera Central foothills and including the Santa Clara Plain. Most of this district is located in the Limon province, Pococí county, and Guápiles district. It consists of the southwest corner of the Guápiles cartographic map (3445 IV). However, this geo-spatial definition should be viewed as tentative and spatiotemporally flexible because our knowledge of social structures of the past inhabitants of the district remains limited. For example, sites on the other sides of the rivers need to be included in the archaeological review in order to determine how they were related to neighboring sites. However, for now they should be considered as possibly being integrated in the same intra-district socio-cultural interaction spheres as sites that are definitively within the district, because current knowledge of these sites indicates they were part of the same cultural system. Nuevo Corinto appears to be the major center of activity in the La Unión District, but a careful review of site reports and a district-wide systematic survey are needed to test this assumption. In this section, I discuss the current state of knowledge about the registered archaeological sites in the La Unión District and attempt to develop an understanding of La Unión prehistory based on our present data on the archaeological record.

La Unión is situated in the fluvial system corresponding to the Caribbean and Northern Sub-Watersheds. The Northern Sub-Watershed corresponds to the drainage basin of the Chirripó

River. The Chirripó River originates from the confluence of the Sucio River with the Hondura, Patria, and General rivers arriving in the Caribbean Lowlands from the Central Highlands and forested Cordillera Central. The Corinto, Costa Rica, Blanco, and Toro Amarillo rivers, all part of the same drainage network, add their waters to the great Chirripó. La Unión is located in a humid tropical forest precipitation ranging from 2500 to 8000 millimeters annually. The temperature ranges from 9° to 25° centigrade (Aguilar Bonilla and Peytrequín Gómez 2003).

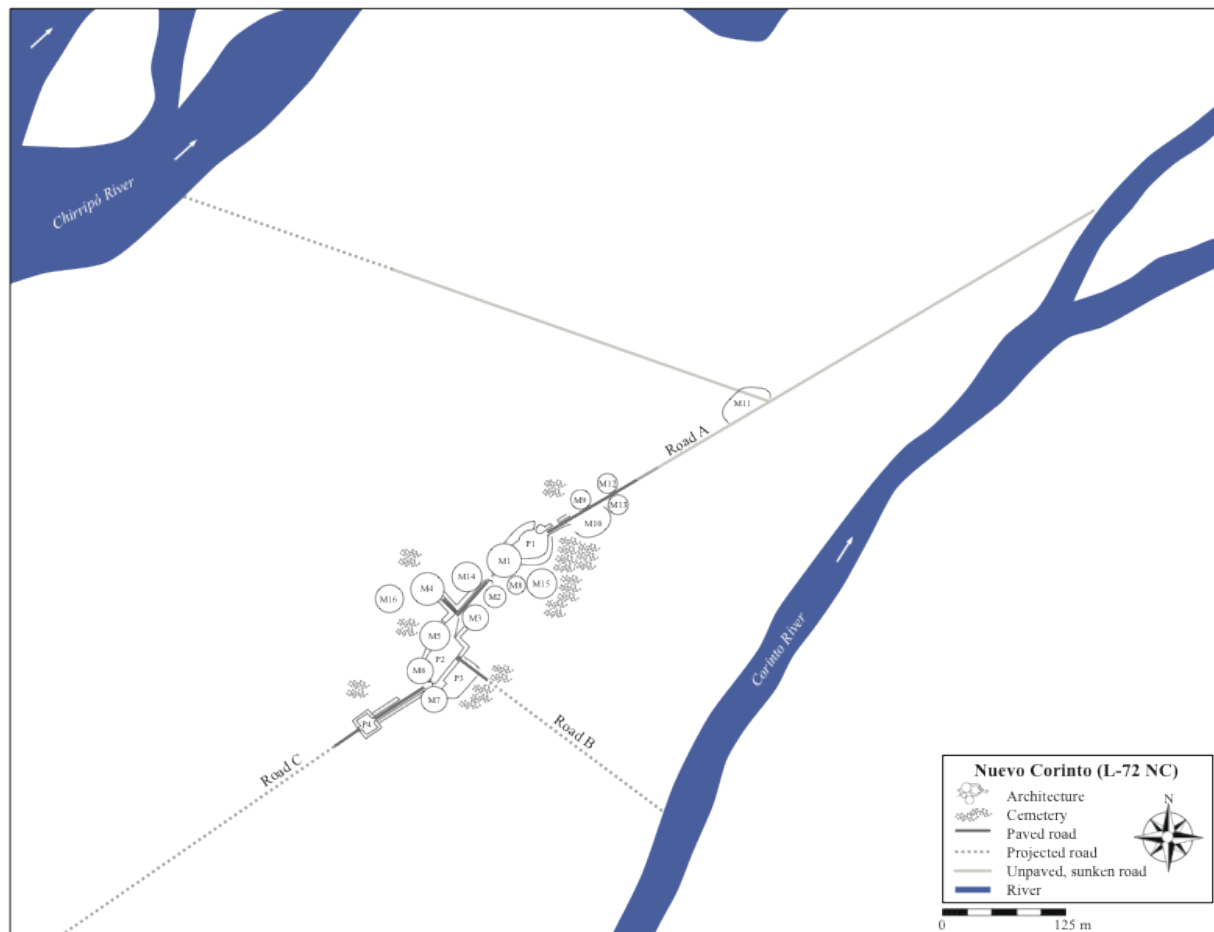


Figure 17. This site plan of Nuevo Corinto (L-72 NC) is based on our present knowledge of the site (redrawn by Antoinette C. Egitto after an unpublished map by George Maloof).

Nuevo Corinto¹⁶ (L-72 NC) (Figure 17) is an architectonically complex site situated just beyond the foothills of the Cordillera Central wedged between the Corinto and Chirripó rivers. No scientific archaeological investigations were conducted at this important site until the past few years. Stone (1977) briefly discusses Nuevo Corinto and other archaeological sites surrounding the modern settlement of La Unión based on information from local looters and the looted artifacts. Looting activities have taken a toll on this site, as they have throughout the region (Aguilar Bonilla and Peytrequín Gómez 2003). An inter-institutional team of archaeologists and archaeology students from the University of Costa Rica (UCR), the University of Kansas (KU), and the Museo de Oro de Costa Rican is conducting the current investigations at Nuevo Corinto. The first archaeological field school of the Proyecto Arqueológico Nuevo Corinto took place during January 2010 with students from the UCR. During the field school, undergraduate students from UCR worked with faculty and graduate students from both universities clearing vegetation from the architectural features and mapping those observable cultural features and other geographic characteristics using a total station surveying device.

¹⁶ Nuevo Corinto is a hydronym, getting its name from the Corinto River. *Corinto* translates to *Corinth*, the name of a Greek city and municipality. I am not certain how or why the river was given this name.

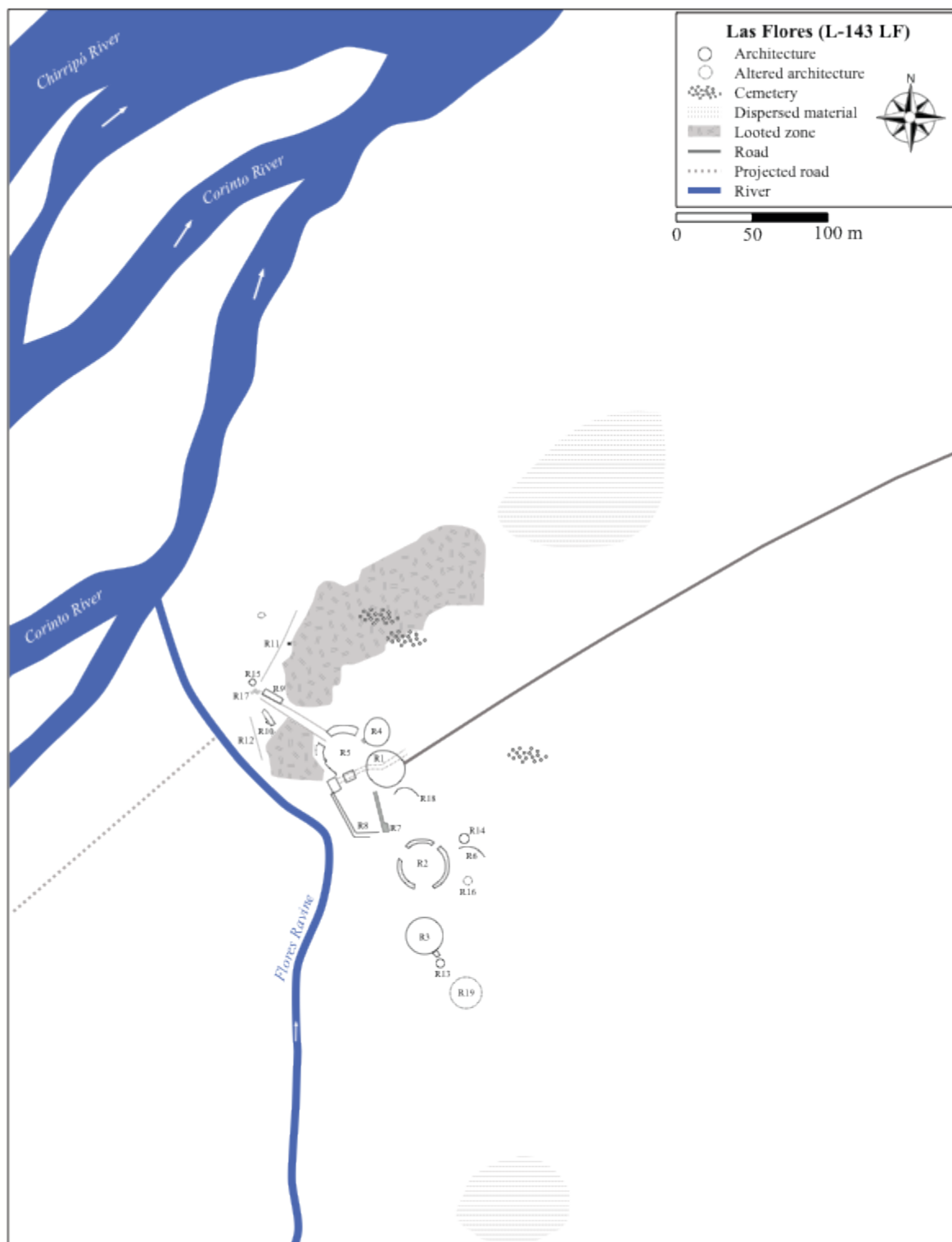


Figure 18. This site plan of Las Flores (L-143 LF) shows the main road and site entrance in relation to the mapped architectural features (redrawn after Vázquez Leiva 2006a:Figure 2).

Las Flores (L-143 LF) (Figure 18) is another archaeological site in the La Unión District that contains monumental architecture. Las Flores exhibits a large circular plaza, many elevated mounds, and at least one cobble-paved road. The general area containing the architectonic structures is about 200 x 50 meters, approximately equivalent to one hectare (Vázquez Leiva 2006a:5). The site is at an altitude of 180 meters above sea level (m.a.s.l.), which is close to the elevations of most of the La Unión District. The registered archaeological sites of Las Flores (Vázquez Leiva 2006a) and El Aluvión (L-144 EA) (Acuña Marín et al. 2005) are realistically part of the same settlement. These sites are contemporaneous to Nuevo Corinto and are located to the northeast of the Corinto River and slightly down stream, indicating that they were probably part of the same community and maybe even sectors of the same site.

Stone first visited Las Flores in the 1960s. During her visit, she photographed the structures, which at the time were better preserved than they are today. Even though the landowners currently protect the site from looting activities, time has degraded the preservation of the site's structures. Salgado visited Las Flores in 2004 as part of a project surveying all of the sites known to have monumental architecture and roads in the Línea Vieja Subregion. During this visit, probably the second time an archaeologists had seen the site, Salgado sought the landowner's permission to conduct investigations of this site as part of the regional survey, since the site was known to contain a cobble-paved road. A summary of the investigations at Las Flores eventually did make it into the report that detailed the results of this regional investigation of architectonically complex sites containing road features (Vázquez Leiva 2006b:44-49). However, the first formal archaeological study and survey at Las Flores was conducted in 2005 as part the inspection and evaluation of the archaeological impact of the construction of the Línea de Transmisión Proyecto Hidroeléctrico General – Subestación Leesville, a power line

construction project for the Instituto Costarricense de Electricidad (ICE). For this evaluation of the impact the construction project would have on the site, Acuña Marín et al. (2005) conducted systematic excavations at the location of each of the electric towers and roughly sketched the architectural complex using a GPS unit to map the exposed features. The excavations within the site were limited to two zones, one to the north and the other to northeast of the aforementioned architectonic complex. These excavations indicated that the two regions differed in age and in cultural function (Acuña Marín et al. 2005:58). The northern sector, which is closer to the complex and exhibited the severe impact of looting, appeared to be part of a large cemetery and contained ceramic sherds associated with Period V (A.D. 500 – 1000) and Period VI (A.D. 1000 – 1550). The zone to the northeast contained ceramic sherds from Period IVb (500 B.C. – A.D. 500) and appears to have been a habitation sector of the site (Acuña Marín et al. 2005:59).

Ricardo Vázquez Leiva, Julio César Sánchez Herrera, and Paolo Barquero later refined the earlier map during three one-day visits in early 2006 (Vázquez Leiva 2006a). They mapped the features of the site using a compass and metric tape, plotting the points of angles and distances between features on millimetric paper and sketching in the rest to capture the basic form of the features. They also took photographs to illustrate the general state of the observable features and recorded GPS coordinates from the center of the principle platform (Vázquez Leiva 2006a:5). The features they observed and mapped include three circular platforms, two circular plazas, three peripheral walls, three “fences” (some curved, some straight), several “shield” tombs, and two roads (one appears to have been the principle access route for the complex and the other connected a distant zone).

The unpaved entryway that appears to have provided principle and formalized access to the site is five meters wide and 55 meters long and is clearly defined by lines of cobblestones on

the sides that extend from the slope of the Flores Ravine to the first circular plaza (R5). This plaza is then connected to the principle platform (R1), indicating that all traffic to the site along the formalized pathway had to pass into the circular plaza and in front of the principle platform. Vázquez and his colleagues interpreted a group of cobbles to the extreme northeast of the entryway in the slope of the ravine to be stairs (R17). Vázquez Leiva (2006a:7) notes that the escarpment from the Corinto River impedes the visibility of structures at Las Flores for all travelers arriving through the entrance from the northwest.

The second road at Las Flores is a cobble-paved causeway. This causeway, going in a straight line from the principle platform six degrees east of magnetic north, is two meters wide, and its length is not yet determined. The landowner told Vázquez that the road leads to a cemetery that is about a kilometer away, an interesting note that still needs to be investigated (ibid.).

Much of the site contains evidence of old looters' pits that turned up the archaeological deposits decades ago. Vázquez and colleagues observed that the sector of the site east of the architectural complex contains a wide distribution of ceramic and lithic remains, which they hypothesized, correspond with habitation activities. To the south of the entryway, they noted what appears to be another funerary zone about 150 square meters in size between the bank of the ravine and the plaza (R5) in another area exhibiting the remains of old looting activity. Four shield-shaped tombs were identified from the remains of looters' pits. These circular tombs were constructed with cobblestones and are known from other sites in the North Pacific and in the Central Caribbean Watershed in contexts with associated ceramics from Period V (AD 500 – 1000).

The map Vázquez Leiva (2006a:8) produced with his colleagues is more complete than the earlier roughly sketched map. Some of the previously undocumented features included a wide pavement (R7) and an angular wall (R8) that marked off a flat, rectangular space to the southeast of the principle platform (R1). While the map that they produced was more complete and the survey they conducted was more expansive, Vázquez and his colleagues did not excavate or make a surface collection from the site. We continue to know almost nothing about the use of the site, the activities that took place there, or the relationship between Las Flores and neighboring sites.

To the south of Nuevo Corinto, two archaeological sites have been registered as Panteón del Jade (H-61 PJ) and El General (H-84 EG) (see Figure 21). Both of these sites are described as cemeteries. The site Panteón del Jade (H-61 PJ) was visited in 1999 by Novoa Espinoza (1999) in response to a report of looting at the site, located one kilometer from the intersection of Highway 32 and the Río Frio road in the Santa Clara farm, Horquetas de Sarapiquí, Heredia. During the inspection of Panteón del Jade, Novoa conducted a survey of the current landowners' property, along with the roadsides leading to the farm and adjacent farms and terraces of the Chirripó River (which included the initially surveyed route where Highway 32 was to be built before the engineers decided the road should be farther from the river). Among the archaeological remains observed in the cultivated fields were lines of river cobbles, ceramic sherds, and other fragmented cultural remains. Near the farmhouse, yet to be described structures were observed. Numerous looters' pits and mounds near the road to the farm and in the river terraces contained river cobbles and fragmented ceramic and lithic remains. The lithic remains included fragments of Flying Panel metates, tripod metates, and a quartz pendant with green inclusions. The observed cultural material is chronologically associated with Period IVb (500

B.C. – A.D. 500). Based on the observations of these surveys, Panteón del Jade appears to be a funerary site. Scientific investigations are needed to learn more about the full extent of the site and the relationship of Panteón del Jade with neighboring sites.

Summary

The archaeology of landscapes of movement is a developing area of research in “off-site” landscape archaeology as we work to gain a broader understanding the interactions and exchanges that occurred among societies deeper in time. The Isthmo-Colombian Area has already been featured in some of this research. The Central Region contains many formalized landscapes of movement. Despite many years of archaeological investigation in the Línea Vieja Subregion, we still do not know much about the functions of the landscapes of movement nor how they interconnected as part of the network of movement served to the pre-Hispanic populations. Over the past decade our knowledge of the archaeological sites surrounding the modern day town of La Unión has greatly increased. This deeper understanding of the settlements and cemeteries of the pre-Hispanic cultural landscape just past the foothills of Cordillera Central and near the Chirripó River seems to indicate a meaningful cluster of archaeological sites, a district of the Línea Vieja Subregion. Next, I present the methods that I will use to study one hypothetical interregional landscape of movement between Nuevo Corinto and the Central Highlands.

CHAPTER 4: METHODS

I use a multifaceted methodological approach to study interregional human movement across centuries in a constantly changing tropical landscape. Crossing the domains of geography, history, and anthropology, I analyze how topographic and sociocultural factors constrained the movement of people who inhabited the dynamically varied landscape of northeastern Costa Rica from A.D. 1000 to 1500 (Period VI). I use three primary methods: (1) archival research to reveal the early history of human movement between the Central Highlands and the La Unión District, (2) archaeological reconnaissance to search for and identify past route segments, and (3) GIS cost surface analyses to answer key questions about human movement.

Archival Research

I conducted most of my archival research in the National Archives of Costa Rica (ANCR). I searched for archival material in the ANCR card catalog and computer database that might reveal information on historic roads and trails between the Central Highlands and the northeastern Caribbean Lowlands. I found about 100 sources dating to between 1860 and the early 20th Century. The majority of these sources are correspondences between government officials and the people contracted to manage or construct roads through the Cordillera Central. This includes an 1860 correspondence regarding the creation of a mule trail between Barva and Santa Clara. I have a series of 37 letters written to the Minister of Public Works by the projects topographer between April 29, 1879 and April 17, 1880. I also have a topographic report conducted prior to the construction of the Carrillo Road dated April 9, 1878. Additionally, I discovered a mix of archival documents related to movement through the Cordillera Central,

including several maps, a few photographs, a couple decrees, and a mix of those documents of lesser significance.

At first, I derived keywords from my limited knowledge about the historic road I knew as *Sucio de Moravia*. As I gained additional information on the geography and toponyms associated with it, I learned that its appropriate names were *Camino a Carrillo*, *Carretera a Carrillo*, and (in English) the Carrillo Road. I conducted database searches for more precise keywords: CORINTO, SUCIO, CARRILLO*CAMINO, HONDURA*CARILLO, CARRETERA*CARRILLO, KEITH*1887, CARRILLO*VIA, BAJO*HONDURA, SAN*JERONIMO. I found correspondences, maps, and other documents directly associated with its construction. The ANCR prohibits photographing archival material and does not provide patrons access to digital scanners. However, upon request, archivists will make black-and-white photocopies, take high-resolution digital photographs, and make negatives of archival material. I made use of these services as needed. I transcribed and coded the correspondences for information related to the history of construction, use, conditions, maintenance, and topography of the road. I digitally stitched together digital photographs of the maps together using Adobe® Photoshop® CS3 and made digital scans of the negatives.

After I gained a better sense of the history of the Carrillo Road, I conducted Google® searches and discovered that Don Sergio Barquero, a park guard for Braulio Carrillo National Park (PNBC) and amateur historian, was an expert in its history. He had become interested in the old cobble-paved road that crossed the national park and for the past two decades conducted extensive research in the ANCR, libraries, and elsewhere. The result of his research is a lengthy unpublished manuscript. Betania Artavia, a reporter for the tabloid newspaper *Diario Extra*, wrote a series of short articles in 2009 that detail some of Barquero's findings (Artavia 2009a, b,

c, d, e). Unfortunately, to date these newspaper articles remain the only publications of Barquero's years of research. To aid in my archival searches, I met with Barquero on two occasions to discuss the possible pre-Hispanic antecedents of the Carrillo Road. Barquero guided me toward additional sources of information in the National Library of Costa Rica (BNCR) on the roads and trails in the study area.

Archaeological Reconnaissance

Informed by the rich archival record about historic human movement, I added another layer of data to my growing dataset by conducting archaeological reconnaissance. Some of this work focused on viewing the attributes of both historic and pre-Hispanic cobble-paved roads and footpaths within the study area, while others were to search for pre-Hispanic archaeological sites along the historic Carrillo Road. Throughout this process, I paid special attention to the site of Nuevo Corinto (L-72 NC) and the surrounding landscape. I observed road construction methods, the situation of sites and roads on the landscape, archaeological evidence for historic and pre-Hispanic roads, and the preservation of roads and related features. I conducted limited archaeological surveys, which consisted of mapping features by collecting geographic coordinates with a global positioning system (GPS) unit.

Myrna Rojas of the National Museum of Costa Rica (MNCR) informed me of an archaeological site, said to contain pre-Hispanic road features, located along the Carrillo Road near San Jerónimo de Moravia in the Central Valley. UCR graduate student Marco Arce and I located La Palma (SJ-501 LP), originally described by José Fidel Tristán, an amateur archaeologist, in the early 1900s (Tristán 2007). We spoke to several local residents of the area, photographed private artifact collections, and did a quick field walk (or transect) reconnaissance of a portion of the site reported to contain mound and road features according to Tristán's map

sketched in the 1920s (Tristán 2007:65). Arce and I attempted to locate the pre-Hispanic stone paved road depicted on the map. During two visits, we photographed all diagnostic ceramic sherds found on the surface as evidence of the duration of site occupation.

Only a few archaeological sites within a five kilometer buffer surrounding the Carrillo Road are recorded in the MNCR database (2012). Coordinating with PNBC, Sergio García, another UCR graduate student, and I were able to enter the park with a guard to search for the site Pava Negra (SJ-73 PN). According to the MNCR coordinates, it is near the path of an old trail once used by park guards. A retired guard told me he used to find ceramic sherds along this path. Although we were able to reach the coordinates with the aid of a GPS unit, conducting reconnaissance with transects in that location, we were unable to locate the site or any archaeological material.

Nuevo Corinto (L-72 NC) received the most attention. I explored Nuevo Corinto's three main roads (A, B, and C) and the surrounding landscape, looking for road or path features and other archaeological material as part of the ongoing research of the Nuevo Corinto Archaeological Project (PANC). I marked all observed archaeological features using the GPS unit, took notes on my observations, and photographed many of them. I used a Garmin® GPSmap® 60CS to map observable road features and collect points associated with my research. Where the road was most difficult to see, I used a T-shaped metal probe and/or compass to follow its path. In the surrounding landscape, I visited and mapped road features at Las Flores (L-143 LF) and behind the gas station near the intersection of highway 32 and the road to Rio Frio. I also explored the site of La Manuda and some of the neighboring land to the south of Nuevo Corinto.

So far, I have not excavated any segments of the pre-Hispanic roads of the La Unión District. However, in January 2010 I was able to study a partially exposed profile of Road C at Nuevo Corinto. The construction of a recent irrigation ditch had transected the road. This provided a general idea of road construction time and techniques that I can compare with published descriptions of similar features.

Collecting information on the early history of human movement between the Central Highlands and the Caribbean Lowlands and making superficial observations of the pre-Hispanic and historic road and path features is not enough to suggest that pre-Hispanic populations would have moved across the landscape in a manner analogous to historic populations. At this stage, it is useful to determine what the optimal routes for human movement between important pre-Hispanic population centers would have been. Given that movement occurred and that we can estimate some of those factors that constrained human movement, GIS queries can be utilized to test the feasibility of proposed paths against the optimal route or transportation corridor between two locations.

GIS Queries: Cost Surface Analyses

GIS, when supplied with sufficient data, provide useful tools to address questions of human movement across landscapes. Cost Surface functions can be used to determine the least cost path (LCP) or least cost corridor (LCC) between two points across a cost raster, a grid of cells each populated with a number representing the cost of movement across that cell. Below, I cite and discuss some of the most influential publications that have utilized GIS to address prehistoric human movement, some of the limitations of the methods they have used, and the methods I use to calculate LCPs and LCCs between the site of Nuevo Corinto and major contemporaneous population centers in the Central Highlands of Costa Rica.

GIS analyses have become standard in archaeological studies of past human interregional movement over the past decade (Anderson and Gillam 2000; Bell and Lock 2000; Bell et al. 2002; Carballo and Pluckhahn 2007; Cooper 2010; Frachetti 2006; Gerbic 2011; Gutiérrez Mendoza and van Rossum 2006; Hare 2004; Heberling 2010; Howey 2007, 2011; Kantner 2004; Llobera et al. 2011; Menard 2011; Sakaguchi et al. 2010; Sherman et al. 2010; Stanish et al. 2010; Taliaferro et al. 2010; van Leusen 2002; Whitley and Hicks 2003; Wiedemann et al. 2001). The most influential research includes Bell and Lock's (2000) use of an optimal path to test a hypothesized relation between Iron Age hillforts and the historic Ridgeway of England, Bell et al.'s (2002) use of cost surface rasters to study Samnite movement as a part of the Sangro Valley Project in Italy, van Leusen's (2002) dissertation chapter that compares and contrasts various cost surface analyses, Kantner's (1997, 2004) use of least cost paths to compare with actual prehistoric roads of Chaco Canyon, and Howey's (2007, 2011) investigations using multicriteria cost rasters and circuit theory to investigate late prehistoric trails in Michigan. The variety of approaches taken in these studies illustrates that there is not one uniform method that has been consistently applied to study past human movement with GIS. However, many of the methods that have been used overlap significantly with each other, especially in how one should interpret them and the limitations that come with them.

LCPs and LCCs are for the most part the result of raster-based analyses that predict the route, specifically or generally, that would be easiest to traverse between an origin and a destination. These can be generated in ArcGIS® 10, among other GIS software packages, by first producing a cost (or friction) raster. A cost raster consists of a grid of cells populated with numbers representing the product of all the known factors that influence human movement through each cell. In a GIS environment, the various influential factors must be represented as

rasters with each cell populated by a number representing the total estimated ease/resistance of movement to the cell compared to all other cells in the raster. One must combine the multiple rasters into a single raster because the GIS can only model movement across one raster.

The factors that influence human wayfinding are complex and require an unattainably deep understanding of the contemporaneous cultural and non-cultural landscape features. The biggest challenge to digitally modeling past human movement is the ability to know those elements—geographical, environmental, and cultural—within the ancient landscape that had a bearing upon the manner in which people moved (Bell et al. 2002:173). Archaeologists can reasonably estimate some environmental/geographic influences on past human movement: topography, land cover, land use, natural resource locations, fresh water sources, settlement locations, and cemetery locations. However, many cultural/non-environmental factors that influence human wayfinding patterns—political boundaries, social divisions, the locations of sacred or taboo spaces/places, the intensity of need for the path—are rarely preserved in the archaeological record and, therefore, are nearly impossible to estimate with much accuracy. Once identified, the archaeologist faces the daunting task of quantifying the variability in resistance (friction) to movement within each layer of influence and subsequently qualifying these factors to determine which had a greater influence on overall patterns of human movement (ibid.). In brief, our database of factors influential to human wayfinding is irremediably incomplete and the quantification and qualification of these factors is subject to user bias, making GIS-based modeling of human movement a challenging endeavor with a substantial margin of error.

Researchers can quantify some influential factors (for example, walking velocity and energy expenditure) using equations based on real world and experimental observations.

Researchers cannot systematically produce other quantifications (for example, how much resistance to movement is caused by the proximity of a cemetery or sociopolitical boundaries) because those resistances must be assumed to have been fluid throughout time and space. The qualifications pose yet another layer of user bias. How are we to know if topography or vegetative cover had more influence on movement over the other? My review of the literature on human movement indicates that different cultures place greater values on different factors, making the development of a universal method for conducting these analyses impossible.

Land cover has been, and continues to be, a frequently cited cost variable in these models (Bell et al. 2002; Howey 2007, 2011; Madry and Crumley 1990). However, each land cover type does not uniformly cause resistance to movement across the portion of the landscape it occupies. Due to this variability, archaeologists face a formidable challenge to quantify the resistance to movement for each cell so it might be included in human movement cost surface modeling. Bell et al. (2002:174) suggest people can, did, and do alter the landscape to facilitate movement through various vegetation types relatively quickly: “swamps can be drained, forests can be felled, and scrubland cleared; even streams and rivers can be bridged, forded, diverted, or navigated” (ibid.). If the influence of land cover on human movement is difficult, the multitudes of cultural influences are virtually impossible to detect or to quantify for GIS use. Bell et al. (ibid.) note that although the cultural influences on movement “are extremely important in our understanding of human interaction with the landscape, they are archaeologically ephemeral.” When deciding what criteria to include in a cost-of-movement model, one must take into account the limitations of each of the possible factors discussed above.

Fortunately, the research conducted in the Arenal District by Sheets and colleagues (Butler 2005; McKee and Sever 1994; McKee et al. 1994; Sever and Sheets 2007; Sever et al.

2003; Sheets 2009; Sheets and Sever 1991) has revealed some of the local factors influencing patterns of human movement. This research reveals that rectilinear, line-of-site movement between locations was culturally important and common throughout much of the pre-Hispanic Era in the Central Region of Costa Rica. The challenge of implementing this knowledge in a cost surface analysis of interregional movement is too great to be used in my study. Line-of sight movement is reported between local destinations, not between distant destinations. If our dataset of archaeological sites was complete enough, we could incorporate line-of-sight movement between each cemetery and settlement along the way. Since we do not have that luxury, I could not include this important observation of past patterns of movement in Costa Rica.

To avoid including ephemeral, or impossible-to-quantify, data in cost-of-movement modeling, one needs dependable data on influences on human movement that are relatively static through time, such as geology and topography. In my models I will rely primarily on topography, the shape and form of the surface of a landscape. At the scale of my research, the present-day topography, while far from static in my mountainous study area, is presumed not to have significantly changed from the late pre-Hispanic landscape and can be used to reliably estimate past topography. Since the Cordillera Central is the major landform between Nuevo Corinto and the contemporary settlements of the Central Valley, I posit this landform had a significant impact upon the location(s) of the path(s) travelers between these locales would have utilized. While topography is important, this factor is not sufficient to actually model human movement. Even though models based on topography are relative, they are the most reliable to use when modeling movement (*ibid.*).

To model the topography of this region, I obtained Shuttle Radar Topography Mission (SRTM) three-arc-second (90 m²) resolution digital elevation model (DEM) data (Jarvis et al.

2008).¹⁷ I brought the DEM, as with all subsequent data, into the Environmental Systems Research Institute's (ESRI) ArcGIS® 10 ArcMap™ and projected it to the North American Datum (NAD) 1983 projection and the Universal Transverse Mercator (UTM) Zone 17N coordinate system. Since four one-degree squared tiles of the DEM were required to cover the study area, I stitched the tiles together using the Mosaic to New Raster function of the Data Management toolbox in ArcGIS® 10. Next, I clipped the DEM to the study area. I then created a hillshade model of the DEM to visually represent the topography. At this point, the DEM was ready for further analyses. The next step is to choose a methodological procedure to create the friction raster and calculate the least cost paths and corridors.

There are a number of ways to model human movement in a GIS using the digital elevation data. These methods consist of applying equations to that data that provide information on such characteristics of human movement as walking velocity, walking time, and energy expenditure. These equations can be divided into two categories based on the types of cost spreading techniques used to predict the optimal human paths and movement corridors: isotropic and anisotropic. Isotropic methods assume that the hypothetical agents' cost of movement is neither positively nor negatively affected by their path's directionality. Anisotropic techniques account for the directionality of the agents' movement (Taliaferro et al. 2010:538). Since

¹⁷ Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) one-arc-second (30 m²) resolution Global Digital Elevation Model (GDEM) data is also available. However, I encountered issues using this data in the Raster Calculator when dividing the raster by any number. I hypothesize extreme outlier values of some cells caused this issue.

Ministry of Economy Trade and Industry of Japan (METI) and United States National Aeronautics and Space Administration (NASA)
2011 Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model (GDEM) V002. ECS Land Processes Distributed Active Archive Center. Electronic resource, <http://reverb.echo.nasa.gov/reverb/>, accessed February 2, 2012.

isotropic methods do not account for different costs of uphill and downhill movement, I will seek an anisotropic model.

Of the possible equations, I use the method of Kantner (2004) who, after weighing the alternatives, chose to use a derivation of Tobler's (1993) "Hiking Function" anisotropic method for modeling human movement. Tobler (1993) created his algorithm using Imhof's (1950:217-220) real-world observations to estimate the velocity it would take a human to cross any given slope. According to these observations, six kilometers per hour reached on slopes between five and seven degrees is the maximum human walking velocity. The average walking velocity across a surface with a zero degree slope is approximately five kilometers per hour (Kantner 2004; Taliaferro et al. 2010; Tobler 1993). The equation developed by Tobler is:

$$V = 6e^{-3.5|s+0.05|}$$

Where:

v = walking velocity in kilometers per hour

e = the base of natural logarithms

s = slope measured in vertical change over horizontal distance (decimals)

This equation, while it has its limitations, remains the most widely used and respected among geographers and anthropologists who model human movement in hilly and mountainous terrain because they have tested it and found it to be a robust method.

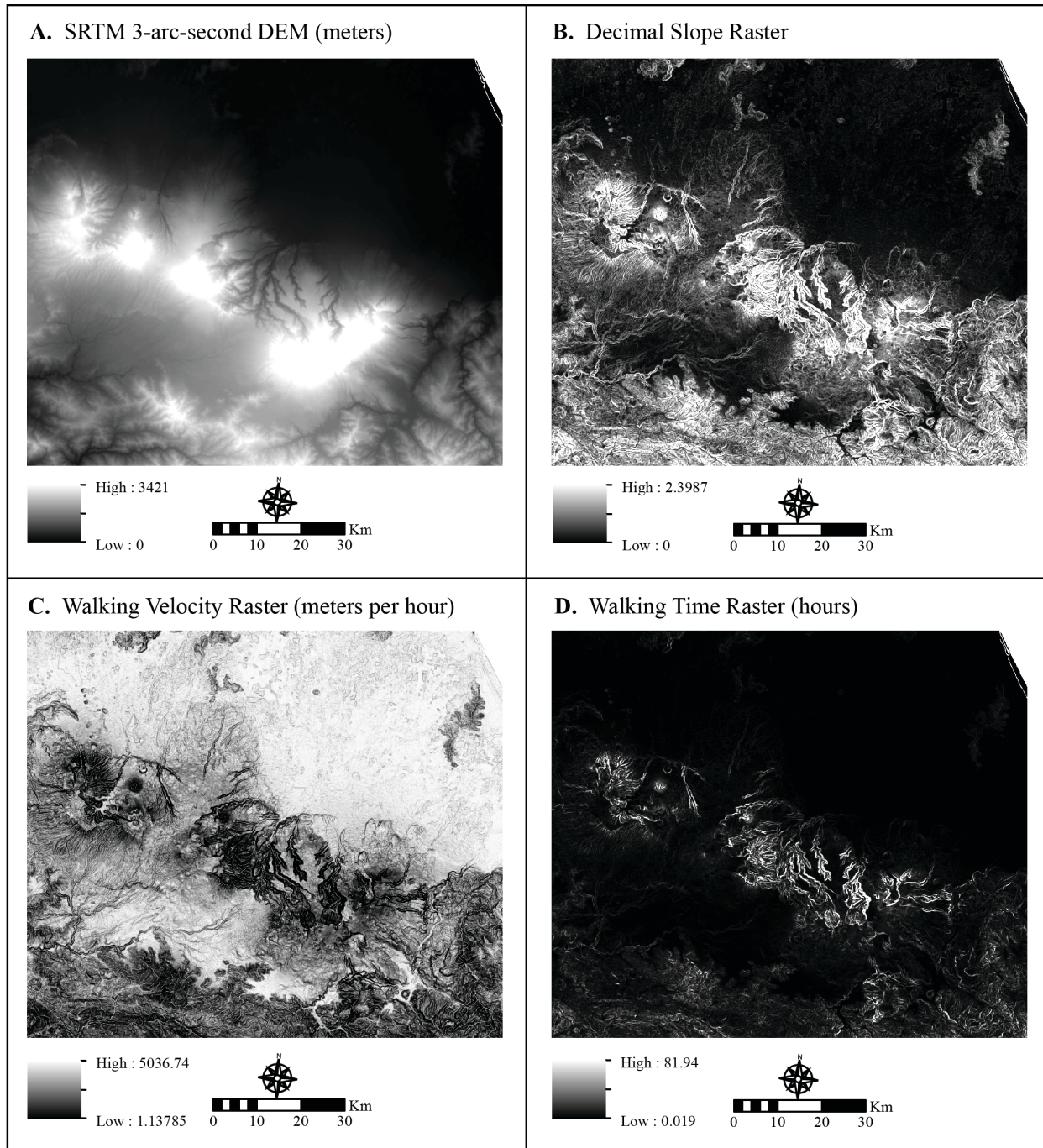


Figure 19. The processes performed to create a cost raster representative of the amount of time the average human needs to walk across each 90 m² cell.

To implement Tobler's "Hiking Function," I first calculated the percent (PERCENT_RISE) slope of each cell in the DEM using ESRI's ArcGIS® 10 Spatial Analyst with a z-factor equal to 0.01 to convert the percentages to decimals. Using the Raster Calculator in Spatial Analyst, I input the "Hiking Function" as $6 * \text{EXP}(-3.5 * \text{ABS}(\text{"DECIMALSLOPE"} + 0.05))$. I then converted this raster into meters per hour by multiplying it by 1000 using the Raster Calculator. The result was a raster with each cell containing the velocity a human could walk through that cell (a velocity raster). To produce a raster of cells populated with the number of hours it would take to cross each cell (a human walking time raster), I used Kantner's (2004) equation, dividing the distance across a cell (93.23154076 meters)¹⁸ by the velocity raster¹⁹. This human walking time raster was ready for me to use to calculate a cost distance raster based on the determined origin of movement (Figure 19). The cells of a cost distance raster are assigned the accumulative cost to the closest cell from a defined origin and are calculated using the Spatial Analyst Cost Distance tool.

To compare the optimal or idealized least cost paths (LCPs) and least cost corridors (LCCs) with the actual, observed historic Carrillo Road, I created a polyline shapefile (a series of connected vector lines that are treated as one). During the Summer 2010, I used a Garmin® GPSmap® 60CS to map some features and collect points associated with my research; this included a portion of the Carrillo Road. These GPS track lines and points were brought into ArcMap™, projected to NAD83 UTM 17N, and pared down in separate layers so only pertinent information would be included. Once I had isolated my limited GPS track of the Carrillo Road, I combined it with a polyline traced from a georeferenced historic map (Archivo Nacional de

¹⁸ The distance across a cell in the SRTM DEM was obtained from its associated metadata. A cell that is three arc-seconds wide is 93.23154076 meters wide.

¹⁹ You can also take the inverse of the velocity raster to get the same cost distance results.

Costa Rica, San José [ANCR], by L.M. Fournier, July 28, 1924, mapa 10221). Then I created a new polyline shapefile that is the closest I can come to an accurate map of the historic road. I then included the pared down point data in another layer.

Next, I used *Orígenes* (Departamento de Antropología e Historia del Museo Nacional de Costa Rica (DAH-MNCR) 2012), the online database of registered archaeological sites maintained by the National Museum of Costa Rica, to create a Microsoft® Excel spreadsheet of registered archaeological sites located within my study area. Next, I edited this database to include more information. This database includes site identification number, geographic region, modern political region, registration number, date registered, site name, site code, type of site, period(s) of site occupation, type of research performed, bibliographic citations for associated publications and reports, estimated altitude in meters above sea level, estimated site area, estimated site diameter, and both the Lambert and Longitudinal/Latitudinal coordinates of the site. Subsequently, I converted the latitudinal and longitudinal coordinates in the spreadsheet of archaeological sites from degrees, minutes, and seconds to decimal degrees. Then I saved the spreadsheet as a .txt file, imported it into ArcMap™, and mapped these sites in ArcMap™ by right clicking on the newly added table and then choosing the function to map the data according to the provided X and Y coordinates. I extracted architectonic, habitation, funerary, and petroglyph sites from the main site database layer and assigned unique symbols.

I made individual layers for each of the largest architectural sites of the Cartago/La Cabaña Phase, assuming that travelers to and from Nuevo Corinto would be more likely to have originated from or have been destined to these population centers. Using the time raster, I

calculated cost distance rasters and accompanying back link rasters²⁰ with the following destinations: Nuevo Corinto, CENADA, Agua Caliente, Alto de Cardal, and Cubujuquí.

To determine the least cost paths between Nuevo Corinto and each of the contemporary population centers in the Central Highlands, I used the Cost Path function in ArcToolbox™. Using the Nuevo Corinto cost distance and back link rasters, I input each of the Central Highland sites consecutively as the destination of movement to produce a series of least cost paths with Nuevo Corinto as the origin of movement. With this data, I produced maps with the various least cost paths from Nuevo Corinto to each of the population centers.

I calculated least cost corridors (LCCs) by combining the cost distance rasters from each of the population centers produced earlier to determine which corridor represents the route of least resistance to movement among all of the population centers. The LCC represents the general route that might have been used to move between locations, rather than the precise path represented by the LCP. This is a technique that has been applied by archaeologists in the past for similar purposes (Carballo and Pluckhahn 2007; Whitley and Hicks 2003) and is the only way to predict what route would be most optimal given multiple origins and destinations on either side of the Cordillera Central.

The benefits of cost surface analyses outweigh its limitations. As with any model, LCPs and LCCs serve only as inductively derived hypotheses that researchers can use to deductively test using various methods, compare and contrast with reality, and refine with additional data. Models help us understand complex phenomena but they are often gross simplifications. They should not be considered definitive and will always benefit from checking and correction. However, they are essential for formulating future strategies of investigation.

²⁰ Cost back link rasters define “the neighbor that is the next cell on the least accumulative cost path to the nearest source” (ArcGIS Desktop Help 10).

Review of Methods

Questions about past human movement are complex and require multifaceted approaches to discern where landscapes and waterscapes of movement might have existed. I combined archival research, archaeological field reconnaissance, and GIS cost surface analyses to build a dataset of knowledge about past human movement across the landscape of northeastern Costa Rica. In my study, the methods are only applied to the study of landscapes of movement. However, the methodologies I have described may be modified to investigate past waterscapes of movement by including rasterized models of fluvial hydrographic flow rates and ocean and sea currents in the GIS data set. The nature of my study area, in a mountainous terrain, was not amenable to the development of such a robust methodology capable of including movement through waterscapes. Nevertheless, with the data obtained using the methods I have described we can proceed from the known to the unknown, from the historic to the prehistoric, from the optimal to the actual human interregional movement behaviors across the topographically dynamic landscape of the Cordillera Central of Costa Rica.

CHAPTER 5: FINDINGS AND INTERPRETATIONS

In the previous chapter, I described the multifaceted interdisciplinary methodological approach that I implemented to build an understanding of human movement through the late pre-Hispanic landscape between the Central Highlands and the Caribbean Lowlands. The objective of this chapter is to present and interpret the data I have gathered and produced. Using a direct historical approach to interpret the archival research on historic roads and paths used to travel between these regions revealed which natural passes could have served as landscapes of movement in pre-Hispanic times. From this data, I hypothesize three possible routes that pre-Hispanic pedestrians might have used to cross this landscape. By way of archaeological reconnaissance, I made observations about historic and pre-Hispanic road construction methods, looked for associations between the archaeological record and historic roads, and mapped road segments with a GPS unit. Additionally, I use least cost path and least cost corridor analyses to test the fit of my hypothesized landscapes of movement. These mathematically modeled landscapes of movement provide predictions of how humans would have optimally moved across the landscape given the previously defined constraints. I compare these optimal routes with the actual historic routes and known pre-Hispanic road segments to test which, if any, of the hypothesized routes makes the most sense to have facilitated late pre-Hispanic communication and trade between Central Highlands and the Caribbean Lowlands. After testing the fit of the hypothesized landscapes of movement, I situate them in the larger network of human movement and interpret them from a world-systems perspective using the current archaeological knowledge of the region to elucidate the past functions these features served.

Historical Landscapes of Movement

Working from what I have learned about historic landscapes of movement, I analogically derive the general locations of three hypothesized late pre-Hispanic landscapes of movement between population centers in the Central Highlands and Nuevo Corinto. While this direct historical approach is limited in its ability to explain past human behaviors, it serves as a starting point from which I can begin to understand how humans might have moved across the same landscape centuries before documented in the historical record. The direct historical approach revealed that either the La Palma Depression or Desengaño Depression natural passes could have served as landscapes of movement in pre-Hispanic times. Based on the data obtained, I hypothesize three possible routes that pre-Hispanic pedestrians might have used to cross this landscape: (1) a route through the General River Valley of the Desengaño Depression, (2) a route through the Hondura River Valley of the La Palma Depression, and (3) a route that follows the ridge between these valleys (see Figure 20). In the following pages, I chronologically summarize the findings of my archival research and then interpret these results according to the three hypothesized routes.

Colonial Period Landscapes of Movement

Early historical accounts of the culture of the inhabitants of the Caribbean Lowlands mention networks of paths, a network of movement. As one example, Benzoni's (1970 [1578]:126-134) 1544 account of traveling into the Central Highlands from *Suerre* on the Caribbean coast with Governor Diego Gutierrez can provide a sense of the characteristics of this network. Benzoni described the first leg of his journey with Gutierrez and his men inland as follows:

We marched five or six days without seeing any habitation whatever; always through woods and over mountains, and of the latter we proceeded down on the descent of which

continued fifteen miles, and in some parts was so steep that we had to hold by the roots of the trees in order not to fall (Benzoni 1970 [1578]:131).

I interpret the difficulty they faced moving along this trail to be indicative of a path that was either unimportant to the indigenous population or had already begun to be overtaken by vegetation. Most likely these Europeans traveled along a trail parallel to the Reventazón River to somewhere near the present day communities of Tuís or Chirripó in Cartago²¹ (Fernández Guardia 1975:97). Accounts like this one can provide a limited understanding of what the network of human movement was like when the Spanish arrived on the scene. However, these accounts are few and far between in Costa Rica. No Colonial Period accounts of travel through my study area are known.

Perhaps due to Costa Rica's late colonization and, until recently, small population, the earliest documentation of a trail or path within my study area dates to the middle of the 19th century. By this time, the landscape was completely different from what it would have been in A.D. 1491. The fast growing vegetation of this tropical environment had overtaken the ruins of the now uninhabited pre-Hispanic communities, which had been decimated by fast spreading diseases before they even met the invading Europeans. The survivors might have maintained some of the network of movement in the centuries that followed, but much of it was, no doubt, erased from the landscape forever. Elsewhere in Costa Rica we know that pre-Hispanic routes were used by the Spanish explorers and later colonists (e.g., Castro Solera 2007). Given that pre-Hispanic landscapes of movement were co-opted during the Colonial Period and that it is easier to travel across an established route than to clear a new one, I proceed with my historical investigation into shallower time, into the 19th century.

²¹ When they reached this area the locals, who had likely already heard about the ruthless party, ambushed them leaving only six survivors (Benzoni 1970 [1578]:133-134).

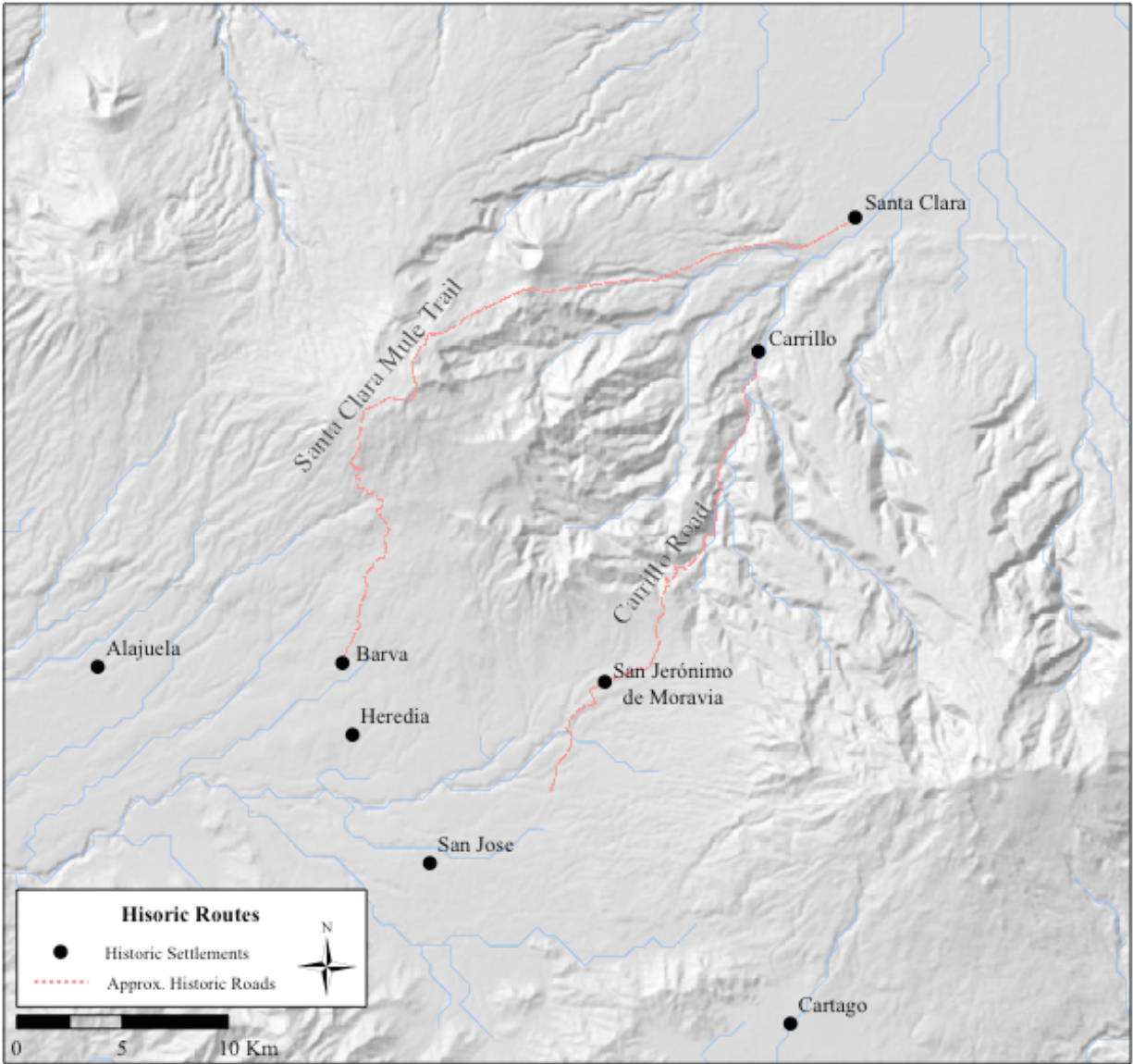


Figure 20. This map shows the historic routes revealed during my archival research.

General River Valley: A Mule Trail from Barva to Santa Clara

The earliest mention of a landscape of movement within my study area dates to 1860, when Dr. José Castro, a farmer who owned land east of San José, wrote a letter to President José María Montealegre Fernández offering to establish a mule road to connect the region of Barva outside San José to the plains of Santa Clara by following the San José River until its confluence with the Sucio River (ANCR, Proposición hecha por José Castro, vecino de San José, al

Gobierno, para hacer un camino de mulas desde las inmediaciones de Barba hasta la confluencia del Río San José con un brazo del Río Sucio, como a 2 leguas del muelle de Sarapiquí, Secretaría de Fomento, unidad documental 001719, January 25, 1860). A month later, the President welcomed Castro's proposal to establish a business transporting goods by mule (*ibid.*). Unfortunately, I have not been able to identify further reference to this mule trail in the ANCR or BNCR.

Sergio Barquero (personal communication, 2010) encountered documentation, including photographs, of this mule road during his years of research. He informed me that this mule trail passed near the Patria River. While the 1860 letters spoke of establishing the mule road along the San José River, the Patria River or General River seem more likely choices given that the headwaters of these rivers originate near Barva. Barquero informed me that he encountered his information in the microfiches of the "Memoria del Ministerio de Obras Publicas" collection at the BNCR. I was unable to locate this collection during my research. However, a map by Fernando Rothe (1927) shows a trail extending from Barva to Colonia Salvador through the Cordillera Central a little north of the El General River and meeting the Sucio River to the south of the confluence with the San José River. Perhaps Rothe's map indicates the continued use of the route from Barva to Santa Clara into the 1920s.

This trail might have been cleared and used soon after Dr. José Castro received the permission of the government to proceed in 1860, but its historical importance in facilitating communication to the Caribbean seems to have been minimal given the attention the nation's presidents gave to establishing a route to the Caribbean in the following three decades. This route might have received so little attention from the government because it was only passable by mule or foot, during an age when faster transportation by cart and eventually train was the ideal. It

appears this route was not constructed as a cobble-paved road or other formal landscape other movement would have been. While this route was not historically important, it seems a feasible candidate for a route with pre-Hispanic origins.

Hondura River Valley: A Brief History of the Carrillo Road

The first historic formalized road to connect the Central Highlands of Costa Rica to the Caribbean Watershed was the Carrillo Road, inaugurated on May 10, 1882. Today, sections of the Carrillo Road are still on the maps as Route 220, which extends from the heart of San José to San Jerónimo de Moravía and, from there, to Bajo de la Hondura, where a dashed line reads “*camino perdido*” (Instituto Geográfico Nacional de Costa Rica (IGNCR) 1967). During its prime, the Carrillo Road connected San José to Carrillo²² near the western bank of the Sucio River at its confluence with the Hondura River and about ten kilometers up river from Nuevo Corinto. From Carrillo, the route continued to Puerto Limón as a railway. In the following paragraphs I will present a brief history of the Carrillo Road, enough to provide a sense of when, where, and how it was constructed, what it was used for, and why it fell out of use.

Before the construction of the Carrillo Road, the only way to export coffee to Europe and the eastern coast of North America was from the port of Puntarenas on the Pacific coast. This meant that to reach some of the best coffee markets, trading ships needed to first circle around the whole of South America (Stewart 1964:1-2). The former dictator-president General Tomás Guardia (in office from 1870 to 1882), sought to establish a direct route, a railroad, to the Caribbean coast for trading coffee grown in the Central Highlands with Europe (Stewart 1964:1-

²² Until 1883, this town was officially named Rio Sucio. In July of that year, the government approved a request to rename the town Carrillo in honor of the former President Braulio Carrillo (ANCR, Decreto n° XXXIII, Cambia á la población que lleva el nombre de “Rio-Sucio” por el de “Carrillo”, Congreso, Signatura 009003, June 5-July 6, 1883). Today, nothing remains of Carrillo, because the 1957 Patillos earthquake caused a huge wall of water that demolished what remained of the riverside settlement are (Artavia 2009b).

2). However, in the late 19th Century “...there was a Costa Rican saying to the effect that a man who once made the trip to the Caribbean coast was a hero, but that he who made it a second time was a fool. This piece of folk wisdom is significant to the extreme difficulty and presumed danger of the journey” (Stewart 1964:21). Constructing a railroad to the Caribbean was going to be a formidable challenge.

In 1870, General Tomás Guardia contracted Henry Meiggs, the American who had constructed railroads in Perú, to construct this railroad (Stewart 1964:9). However, Henry Meiggs’s soon turned the contract over to his nephew, Henry Meiggs Keith (Stewart 1964:18). Henry Meiggs Keith invited his brother, Minor Cooper Keith to come to Costa Rica and help him build the railway. Minor Cooper Keith came to Costa Rica, and even though he had never built a railroad before, eventually took over the contract to build the first formalized route to the Caribbean coast in Costa Rica’s history.

The original contract called for a railroad connecting Alajuela to Heredia to San José to Cartago and from there to Puerto Limon via the Reventazón River valley. However, the crew did not perform sufficient preliminary studies of the topography, and not far past Cartago faced an unsolvable obstacle in the form the huge Fajardo Rocks geologic formation made of lava and breccia. Nothing the road crew tried would level this sixty-one meter high, three kilometer wide obstacle in their path (Artavia 2009d). When the efforts in Fajardo were abandoned, an alternative route to the Caribbean was needed. The proposed solution was the route through the La Palma Depression north of the Turrialba and Irazú volcanoes (Peraldo Huertas and Rojas Cedeño 1998:102). Beyond the geologic barrier the Fajardo Rocks presented, bypassing Cartago by using the La Palma Depression might represent a punishment to that community for so political offense (Stewart 1964:39-40). Whatever the rational, crossing from Alto de La Palma to

the Sucio River and from there to Puerto Limon seemed to be the answer, but this time they invested in a survey of the landscape before beginning.

On April 9, 1878, the topographer J. Ricardo Alpízar submitted a report on the landscape of the proposed alternative route to Limón (ANCR, Informe de los estudios preliminares por la Vía Palma Río Sucio by J. Ricardo Alpízar, Sección Administrativa, Unidad documental 000797, April 9, 1878). Alpízar calculated a slope of approximately 3.5% in the route from La Palma to the Sucio River. The difficult task in the construction of the proposed railroad from La Palma to Limón, Alpízar predicted, would not be the terrain, but the construction of bridges over the rivers Reventazón, Sucio, and Amarillo (Peraldo Huertas and Rojas Cedeño 1998:102). Alpízar's topographical report gave the impression that the La Palma Depression would make an optimal route to the Caribbean lowlands.

Early in 1879, General Guardia led a group government officials and Minor Keith across the same territory that Alpízar surveyed the year before. On horseback, they traveled from Siquirres to Carrillo and back discussing the possibilities of running the railway through this terrain (Stewart 1964:39). Keith thought it a good route and, on September 8, 1879, signed the contract to build the railroad from the Reventazón to the Río Sucio at Carrillo, a section some thirty miles long. The terrain here was challenging due to the many rivers that had to be bridged, as Alpízar had predicted. By 1882, Keith and his crew had constructed the railroad from Puerto Limón to Carrillo (~112 kilometers).

The next project was the section of railroad from Carrillo to San José to complete the route. However, General Guardia's government could not afford to complete the railroad at that time (Stewart 1964:44). On July 13, 1881, Keith, Fernández, and Tristán were contracted to temporarily complete the route by building the Carrillo Road. This cobble-paved cart road would

be used to transport goods to the railroad station in Carrillo until funds could be raised to put down rails (Stewart 1964:45). This section would become the most controversial of the project, because it used up so much money and time. Steep geographic reliefs with slopes surpassing 20% created frequent technical problems in the construction of this section (Peraldo Huertas and Rojas Cedeño 1998:102).

The Carrillo Road was inaugurated on May 10, 1882, resolving the difficulties of communicating with the Caribbean side of the country, the province of Limón. General Guardia was too ill to attend the inauguration ceremony and died two months later. His dream of a route to the Caribbean became reality, but the challenge of completing the railroad to San José was left to other hands (Stewart 1964:46-47). In 1883, Keith's engineers surveyed the La Palma Depression/Hondura River Valley to determine the cost of constructing the railroad from Carrillo to San José. Based on their report, Keith argued for the abandonment of the plan to build this railroad. Among the points he made to the government was that the 26 mile distance between Carrillo and San José would be artificially increased to 50 miles to keep a two percent slope gradient. Furthermore, the cost of constructing this stretch of railroad would be so uneconomical that an alternative route would make more sense. In search of a more economical route, Keith commissioned a new topographic study along the Reventazón. This study revealed that by rerouting the railroad through Paraíso, the railroad would avoid the Fajardo formation altogether. The government approved this plan and contracted Keith to begin the project in 1886 (Stewart 1964:62).

Soon after the inauguration of the Carrillo Road, Keith leased the road and railroad for five years beginning in 1882 (Stewart 1964:48). By leasing the route he gained control of the route so he could use it to transport bananas from his plantations, but by doing so, he became

responsible for all services, maintenance, and repair of the road and rails. The Carrillo Road, as it turned out, was difficult to maintain and would frequently become impassable and cause accidents during the rainy season, which lasts half of the year from April through October. Stewart (1964:61) explains “the tremendous rains washed out bridges and caused [land]slides with monotonous and very costly regularity.” In some cases communication would be cut for two weeks as repairs were made (Stewart 1964:91). Furthermore, the conditions of the road could change from perfect condition to impassible overnight after a strong rain (ANCR, Informe prentado por C.F. Willis por encargo especial de Minor Cooper Keith relativo a la carretera entre la ciudad de San José y Carrillo, Secretaría de Fomento, Sección Administrativa 001286, November 23. 1887). Besides the uncertainty of the route for communication purposes, it was also dangerous. An unknown number of deaths resulted from the many accidents caused by road conditions (Artavia 2009e). The travelers and merchants who depended on Carrillo Road complained about Keith’s management of it. In particular, coffee exporters asserted that Keith was not furnishing them enough cars to transport their crops, because his first priority was the exportation of his own coffee and bananas (Stewart 1964:91).

The opening of the new railroad line from Puerto Limón to the capital via the Reventazón Valley on December 7, 1890 (Stewart 1964:97) diminished the use for the Carrillo Road. However, the importance of maintaining this more direct route from San José to Limón via Carrillo was still emphasized to the government by citizens of the nearby communities who continued to depend on it to access their land and/or for trade needs. In 1889, Keith was fined thirty thousand pesos by the government for not maintaining the road as his contract required (ANCR, Comunicaciones cruzadas entre San José y Carrillo relativas al recibimiento de la sección entre Río Macho y Carrillo, Secretaría de Fomento, Sección Administrativa 001390,

February 1889). The following year the section of railroad between Carrillo and Toro Amarillo was closed for the expense of maintaining it was determined to exceed its benefits (Stewart 1964:109). The road continued to be used by the inhabitants of Santa Clara, Corinto, Patria and Carrillo until 1950 when most of them moved away because the government would not maintain the road due to the difficulty associated with its maintenance (Núñez 1995). In 1965 a major bridge was destroyed and never repaired, severing communication beyond La Boca del Infierno (Artavia 2009e).

Intriguingly, sections of the Carrillo Road are still used. Beginning at least by the 1950s, portions of the Carrillo Road were paved over with asphalt, a trend that has reached as far as La Palma (Zavaleta 1957). Today, a large portion of the Carrillo Road lies within the Braulio Carrillo National Park (PNBC) established in 1978, where plant life is gradually overtaking the cobble-paved road surface. I suspect if it were not for the nature lovers from the San José area who occasionally illegally hike the trails, the religious pilgrims who visit the dilapidated chapel dedicated to Bishop Thiel near its midpoint (Artavia 2009a), and the park guards who patrol this territory, the road would be in worse condition.

Clearly, given the amount of human labor needed to construct and maintain the Carrillo Road, it has no direct prehistoric origin. This fact does not rule out the possibility that the La Palma Depression might have facilitated pre-Hispanic interregional communication and exchange. By studying the nature of human movement through this valley during the 19th Century, I have learned about the conditions that may have influenced pre-Hispanic movement, if it were channeled through this same terrain.

During the short history of the Carrillo Road travelers faced near-constant rainfall and numerous landslides. Flowing water would frequently wash out sections of the cobble-paved

road surface. Considering the rate at which the rainforest has reclaimed and even erased sections of the Carrillo Road in the past fifty years or so, it would not be surprising to discover that the pre-Hispanic peoples of Costa Rica once constructed and maintained an interregional cobble-paved road, since reclaimed by the rain forest. However, we can safely assume that thousands of years of situated/lived familiarity with the landscape and its characteristics would have affected how people moved across their environment. Knowing how rapidly the landscape changes, these people would not have constructed a road, but likely used a path/trail. The flexible nature of a trail would allow pedestrians to change course whenever needed. Therefore, just because the dynamics of the Cordillera Central landscape impeded the permanence of the historic route does not signify pre-Hispanic peoples would have been so constrained.

On Higher Ground: A Trail Through the Río Clara Farm

In the ANCR, I encountered a map dating to 1961 that depicts a trail that extends from the Carrillo Road through the Río Claro farm and the Braulio Carrillo Highway (under construction) and then intersects with the Patria River at the northern margin of the map (ANCR, Plano de una finca, propiedad de la Hacienda Río Claro, Ltd, situada en El Bajo de la Hondura de Coronado, distrito 3^o, cantón 1^o, provincia de San José, by Moya Fernández, Servicio de Parques Nacionales, Scale 1:5000, Mapa 021729, September 1961). Given what we know about the cultural landscape, it is probable that this trail could have once extended to Carrillo along the Patria River.

In July 2010, I asked a retired park guard, about the possible existence of pre-Hispanic roads or trails within Braulio Carrillo National Park. He reported that, during the early years of the park, the guards utilized an older farm trail when patrolling the terrain between the Hondura and Patria river valleys. This trail crossed the mountains going from the Patria River to Bajo de

la Hondura where it connected to the Carrillo Road. According to this park guard, areas of the described route contained evidence of pre-Hispanic activity, including fragments of ceramic vessels. He had walked all over the park and only recalls observing archaeological remains in this particular section of the park.

It appears the trail through the Río Clara farm might be the one described by this former park guard and therefore, is important to identify to locate the archaeological refuse mentioned. His suggestion that a trail crossing through higher ground was associated with pre-Hispanic archaeological remains led me to search for any registered sites in the database of the National Museum of Costa Rica. Later in this chapter, I will describe our current knowledge of the only two archaeological sites registered in this area: Pava Negra and Cerro el Coronel.

The Braulio Carrillo Highway

From the abandonment of the Carrillo Road, a direct route did not exist between San José and Puerto Limón until 1987 when the Braulio Carrillo Highway, Route 32, opened for use. By this time the semi-trailer truck and asphalt-paved highway had replaced the technology of the ox-cart and cobble-paved road. Perhaps in an attempt to avoid the persistent problems of the Carrillo Road, the transportation engineers built the Braulio Carrillo Highway along the side of the Zurquí Mountain overlooking the La Palma Depression. Nevertheless, anyone who has ever traveled to somewhere in the Caribbean Lowlands from the San José along this highway knows that travel is just as uncertain today as it was 131 years ago.

Summary

The available historic documentation of intermountain communication routes in my study area focuses on the late 19th century and primarily on the Carrillo Road. While the archival research did not reveal continuity from pre-Hispanic to historical landscapes of movement,

knowing the history of human movement across this landscape reveals some of the geophysical factors that might have limited how, when, and where people moved. Based on historical observations of human movement in the 19th century, I have hypothesized that pre-Hispanic peoples might have used the Desengaño Depression, the La Palma Depression and/or trail through higher ground. It would be an enormous and erroneous leap to claim the pre-Hispanic inhabitants of Costa Rica used either/any of these routes without analyzing their trajectories with respect to the archaeological evidence of past human movement.

Archaeological Reconnaissance in Search of Pre-Hispanic Landscapes of Movement

The archaeological evidence for landscapes of movement in my study area is limited to the immediate vicinity of a handful of sites. In chapter 3, I described the present archaeological knowledge of sites in the La Unión District: Nuevo Corinto, Las Flores, El Aluvión, El General, and Panteón del Jade (Figure 21). Of these sites, the only pre-Hispanic road and path features known are associated with Nuevo Corinto and Las Flores. The reconnaissance I conducted throughout the environs surrounding Nuevo Corinto served to identify and map additional landscape of movement segments, while the archaeological research I conducted at Pava Negra and La Palma (Figure 21) were to explore any potential relationship these sites might have had with pre-Hispanic populations of the La Unión District (i.e. when were they occupied and did they contain similar types of material culture). As I described in chapter 4, I viewed the attributes of both historic and pre-Hispanic landscapes of movement and collected data on associated sites and road/path/trail features with a GPS unit. This section contains all of the data I compiled related to landscapes of movement within my study area during my summer 2010 fieldwork. I begin my discussion of archaeological reconnaissance with the La Unión District and then describe my observations on Pava Negra and La Palma.

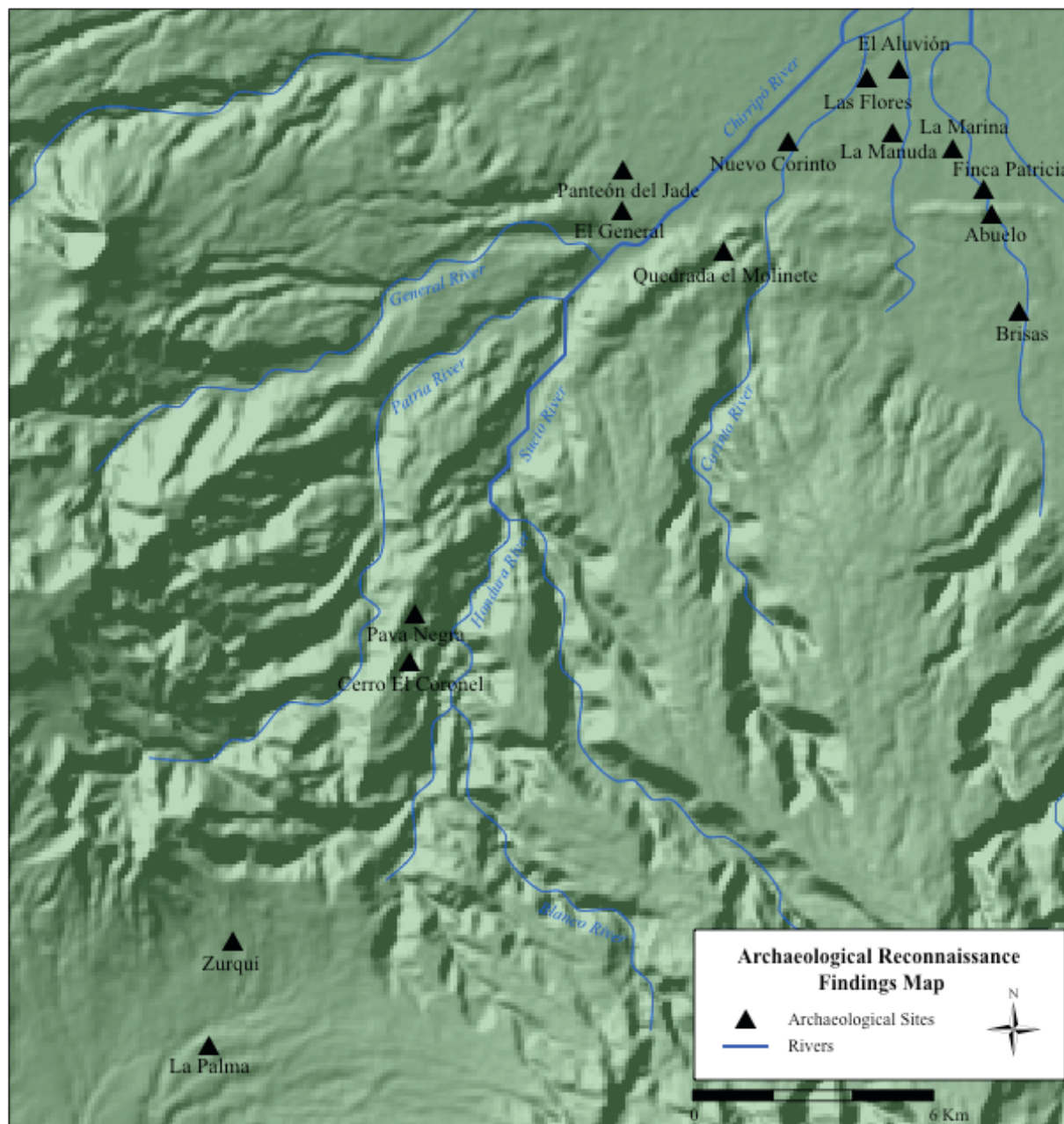


Figure 21. This map shows the locations of archaeological sites in the La Unión District in the northeast corner and other sites mentioned in the text.

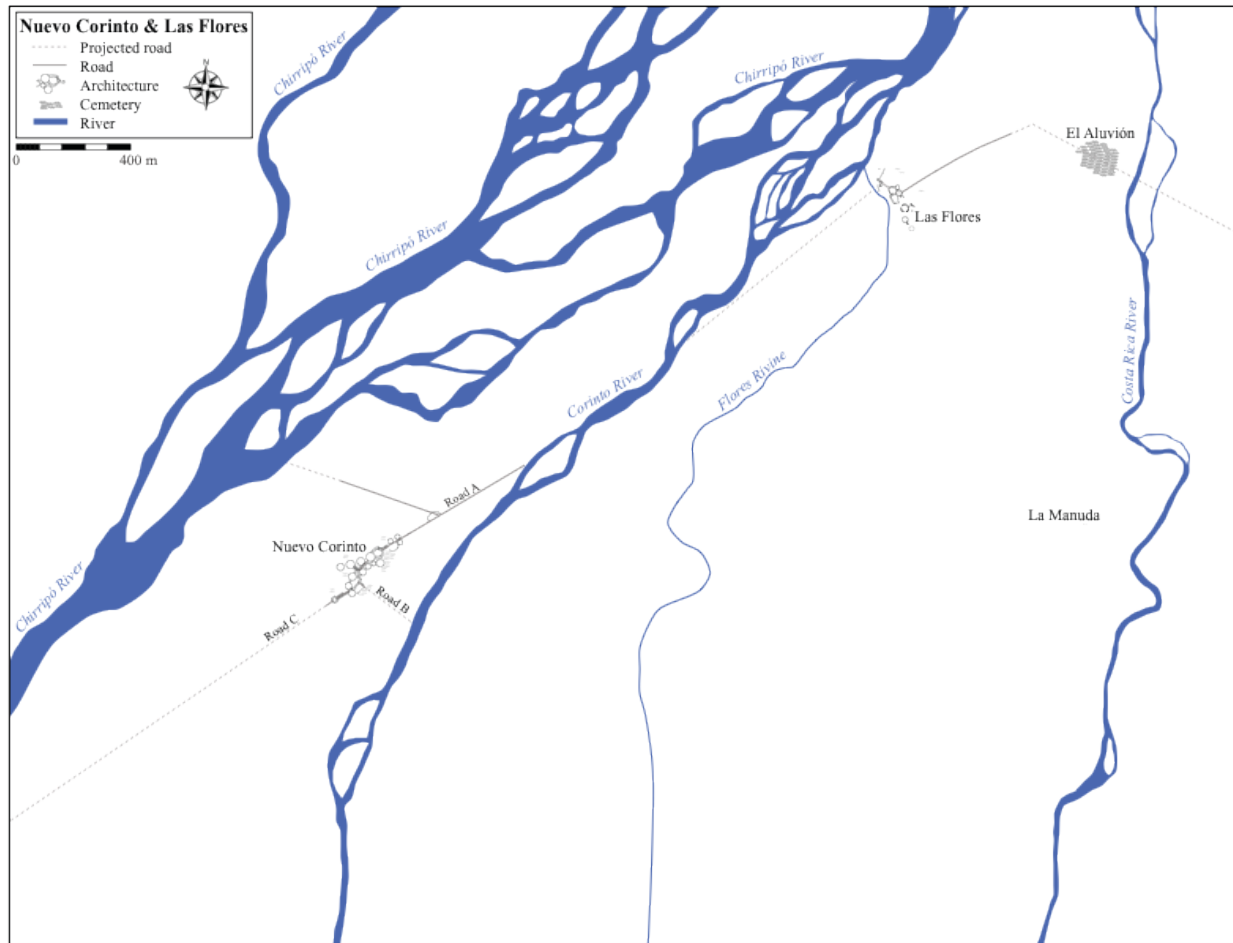


Figure 22. This map shows the projected road connections among Nuevo Corinto, Las Flores, and El Aluvión in the La Unión District.

The La Unión District

In the La Unión District, Nuevo Corinto and its immediate surroundings (Figure 22) received the most research due to my involvement in the Proyecto Arqueológico Nuevo Corinto (PANC). Beginning with the architectural center at Nuevo Corinto, I present my archaeological reconnaissance data on this district. As I mentioned earlier, Nuevo Corinto has three documented/mapped roads (A, B, and C). During the 2009 and 2010 field seasons, project participants mapped most of the identified architectural remains, including roads. No one has excavated segments of these roads. For this reason, our present knowledge of these features is

limited to the observations we can make from the surface, from the air (limited remote sensing in Google Earth), and with T-shaped subsurface probes. We assume the roads date to the Period VI as we have dated some associated architectural features (e.g. Mound 7) based on stratigraphic excavations.

Road C originates between mounds 6 and 7 and passes through Plaza 4. While I have not excavated any segments of the pre-Hispanic roads of the La Unión District, I was able to study a partially exposed profile of Road C. This profile, made by the excavation of a recent irrigation ditch northeast of Plaza 4, revealed the construction technique and date of Road C. Based on the cultural material found above and below the pavement, I have determined that the inhabitants of Nuevo Corinto built the road sometime between Period V and Period VI. Similar to the descriptions of paved roads at Guayabo and Las Mercedes-1, these people paved the surface of their road with one layer of uniformly sized river cobbles.

Marc Arce and I followed the paved surface of Road C for about 40 more meters, although it is not easily visible. Beyond this point, the road has eluded detection. We explored the pasture—covered in tall grass at the time—where Road C is projected to extend. Equipped with a compass, GPS unit, and site map, we first located the identified road segment at the entrance of Plaza 4. We aligned ourselves with the exit of Plaza 4 and followed the projected direction of the road, looking for any linear elevation changes (rises or swales), cobblestone accumulations, or vegetation differences that might indicate the extension of this road. After walking 520 meters without locating any indicative features, we stopped our search. Observing the landscape within the projected trajectory of Road C beyond the location where we stopped, I observed a slight linear change in vegetation extending to Highway 4 (the road to Rio Frio) in

the Google Earth imagery. Future researchers should investigate this section of the site through survey and excavation to determine if the linear anomaly is an extension of Road C.

The existence of Road B remains hypothetical. Subsurface exploration with a T-shaped metal probe reveals a high concentration of rocks in a linear alignment in a southeasterly direction beginning at the exit of Plaza 2 and extending through Plaza 3. The modern road and the construction of the small water reservoir for the ice factory disturbed the portion of the site between approximately 20 and 70 meters from the outer southeast wall of Plaza 3. We have yet to conduct archaeological surveys between the southwest side of the reservoir and the Corinto River. However, preliminary reconnaissance reveals some linear arrangements of river cobble that appear to be cultural. One such linear arrangement is perpendicular to the linearly projected Road B. I photographed some of these features, but this was not sufficient to illustrate what I observed. The trajectory of the projected Road B is the most direct route to the Corinto River from the architectural center of the site. Assuming this road did exist, it might have been the path used to walk to the river to bathe, to fish, and/or to procure other river resources (including cobbles for construction). Further investigation, including survey and excavations, are needed to interpret the observed features.

In the banana fields to the northwest of the architectural center of Nuevo Corinto, I observed several level cobble-paved features that appeared to be road segments on the basis of their architectonic similarity to identified roads of the same general time period, like those at Las Flores (L-143 LF). I recorded the locations of these features with GPS points and short descriptions. This section of the site is not yet mapped and highly disturbed on the surface due to modern agricultural land use practices. At this point, I can only draw the analogy between the

small segments of cobble pavements I observed in the banana fields and the road pavements I observed at La Flores.

Originating out of Plaza 1, Road A can be clearly seen in satellite imagery and from the surface. It extends outward in a northeasterly direction. Before exiting the architectural complex, the road is flanked by two sets of mounds: first by mounds 9 and 10 and then by mounds 12 and 13. The segment of Road A between the plaza and these mounds seems to be paved, based on subsurface explorations with a T-shaped metal probe. Between the mounds and the paths intersection with the Corinto River, Road A is not paved, but sunken. We do not yet know if this segment of Road A was sunken intentionally or through erosion processes caused by repetitive use. This road is about 650 meters long and more-or-less one meter wide. However, based on surface observations and subsurface explorations, Road A is about three meters wide at its intersection with Plaza 1. At the end of Road A, near where it forms an acute angle with the river, there is a feature analogous to the features R31, R32, R35, and R36 at Las Mercedes-1. I photographed and located this feature using GPS points, but it still needs to be mapped.

Proceeding in a linear northeasterly direction, there remains a distance of about 1,800 meters between the architectural features at the end of Road A and the entrance to Las Flores. This unmapped section of land might contain preserved path segments, but they are not visible in Google Earth. What are visible in this terrain are numerous dry channels of this braided portion of the Corinto River, indicating the active transformation of the landscape. This situation is not conducive to archaeological preservation in the immediate vicinity of the river, but does not exclude the possibility that path segments might persist here. Another possibility that needs to be entertained is the navigability of the Corinto River at this point.

Two and half kilometers downriver from Nuevo Corinto, Las Flores (L-143 LF) is located to the south of the confluence of the Corinto River, the Flores Stream, and the Chirripó/Sució River. The entrance to the site is situated at the point of the site nearest to this confluence. Earlier projects (Acuña Marín et al. 2005; Vázquez Leiva 2006a, b) mapped the architectural features at Las Flores. For my own purposes, I GPS-mapped a portion of the cobble-paved road that extends to the northeast. Additionally, I photographed exposed sections of the road surface near the architectural center of the site to use for drawing comparisons with the road features at Nuevo Corinto and at other Period VI sites. This main road at Las Flores leads to a cemetery site named El Aluvión (L-144 EA). Based on observations in Google Earth, the road turns to the southeast near the El Aluvión cemetery and continues over the Costa Rica River and beyond for at least 1,650 meters in a near-perfect line. This section of the road needs to be mapped and ground-truthed to verify that it is not an historical produced feature, but I am reasonably confident that this is a pre-Hispanic road.

I conducted reconnaissance to the south and west of Nuevo Corinto. I explored the farm and forested areas on the south side of Highway 32 from Nuevo Corinto, but did not observe any archaeological remains in this terrain. However, a local informed me that there is a cemetery somewhere on this side of the highway. A systematic survey of this terrain is needed.

I also conducted reconnaissance in the section of land behind the gas station at the intersection of Highway 32 and the road to Río Frio (Highway 4). Speculating that if Road C of Nuevo Corinto continued outward it might be visible to this side of the river, I conducted a zig-zag, non-systematic reconnaissance of the land between the highway and the Chirripó (Sucio) River. Some informants mentioned an old road behind the gas station. This old road appeared as a historic cobble-paved road. This road was probably used before the construction of the

highway. The construction style was distinct from that of the Carrillo Road, but this might be a remnant of the same historic route. Perhaps it paralleled the railroad. Whatever its origin, it was decisively not pre-Hispanic. Much of the terrain appeared altered due to a combination of the construction of this road and fluvial erosion. No pre-Hispanic cultural material was identified on the surface or in the profile of a deep modern trench. Since I was there, I mapped the length of this road using the GPS track feature and later discovered that it is easily recognizable in Google Earth imagery. One can follow this road in Google Earth up to the location where Carrillo once stood before the flood caused by 1957 earthquake destroyed it.

Farther to the southwest of Nuevo Corinto, a local farmer showed me a cluster of boulders on the northern edge of the Molinete Stream²³ that people had once used as metates and mortars. The southern edge of the stream was characterized by a cliff with a rock formation containing linear striations the farmer identified as a mine for the flat stones or flagstones used in the construction of tombs in this region from A.D. 1000 to 1550 (see Snarskis 1978:71). While the later hypothesis needs to be further investigated, the boulders were clearly used for grinding or preparing something in a manner consistent with pre-Hispanic practices observed at many archaeological sites in the region. This location is about one kilometer away the streams confluence with the Corinto River and about three kilometers to the south-southwest of the architectural center of Nuevo Corinto.

Pava Negra and Cerro El Coronel

There are only two registered archaeological sites within the intermountain portion of my study area. My interest in learning about these two sites, Pava Negra (SJ-73 PN) and Cerro El Coronel (SJ-43 CC), was heightened when I by the account I described earlier of an old historic

²³ He referred to the stream as “Quebrada las Minas,” but the topographic maps call it the “Quebrada el Molinete.”

trail associated with pre-Hispanic material that passed through the same sector of the PNBC. Unfortunately, the DAH-MNCR (2012) does not have much information about these sites in its database of site files and could not locate the site reports for these sites during my field research. Therefore, all I know about these sites is what is included in the *Orígenes* database. In this section I present that information a brief account of my attempt to locate Pava Negra one day in July 2010, and my interpretation of the relevance of these sites to a possible pre-Hispanic landscape of movement through this terrain.

These sites were registered in the 1980s around the time when the Braulio Carrillo Highway was constructed. Archaeologist Magdalena León registered Cerro El Coronel after she was informed of archaeological material that had been discovered in some cultivated land not far from the new highway. She conducted an unsystematic prospection of the site and made an arbitrary surface collection of cultural refuse (all or mostly ceramic sherds). Based on the ceramic sherds she recovered in the area of about 200 square meters, the site dates 500 B.C. to A.D. 300. Pava Negra, about 1.5 km to the north of Cerro El Coronel, was officially registered by Myrna Rojas on the behalf of Luis Saenz, the Costa Rican naturalist I mentioned earlier. We know even less about Pava Negra than Cerro El Coronel. Based on the observations Saenz reported to MNCR, Pava Negra is a La Cabaña/Cartago Phase cemetery with an area estimated to be 7000 square meters.

After obtaining permission from PNBC, I entered the park with UCR Master's student Sergio García and a park guard, attempting to locate these sites with the help of a young park guard and my colleague Sergio Garcia. Based on the known topography and vegetative cover associated with the coordinates of Cerro El Coronel, we decided it would be too difficult to visit without more time to plan. We settled for only locating Pava Negra, because it was ore

accessible from the highway. We used GPS units to locate the registered coordinates of Pava Negra, is located some fifteen kilometers to the south-southwest of Nuevo Corinto. After locating the coordinates of Pava Negra and searching all over the vicinity, we found no evidence of archaeological remains and returned to the highway where we had entered the park. Therefore, I still cannot prove if these sites were associated with a trail. A systematic survey of the vicinity is needed to relocate and determine if Pava Negra and Cerro El Coronel might have been associated with the contemporary settlements of the La Unión District to the northeast.

Both Pava Negra and Cerro El Coronel are located within a few kilometers of the Carrillo Road ruins. If the general route of the Carrillo Road has a pre-Hispanic antecedent, then the presence of habitations and cemeteries near the route would have affected human movement. Considering habitations, friendly populations would have attracted movement; where as, unfriendly people would have repelled movement. Similarly, cemeteries can attract or repel movement. If we knew the degree to which these features affected movement, we could include them in the GIS models. However, the influences of these factors remain unknown.

Based on my observations of the landscapes near Pava Negra, ridges appear to be an easier location at which to maintain a trail compared to the land surrounding rivers. The vegetation is naturally less dense on ridges than on land near rivers, making a ridgeway trail easy to follow and maintain. The ridges on which I walked within PNBC were easier to use than was the lower ground near the river. Ridges have natural drainage and accommodate less and more dispersed vegetation. Furthermore, ridges provide travelers with a good view of their surroundings, a characteristic that may have been favored for both safety and esthetic reasons. However, walking on ridgeways might also be a disadvantage for travelers crossing through territory patrolled by enemies and other unfriendly types. Additionally, landslides would have

been a safety issue, but landslides were likely more dangerous in lower ground. The positive characteristics for the use of a ridgeway have led me to posit that ridges need to be considered along with river valleys as plausible settings for landscapes of movement.

The entire intermountain region occupied by PNBC remains mostly unknown to archaeologists. This is due to the difficulty of conducting surveys in the mountainous and heavily vegetated terrain of this park. My attempt to learn more about the archaeology of this landscape was not fruitful, but this only means we need to organize greater effort to relocate and survey these sites while searching for additional evidence of pre-Hispanic human activity in this difficult terrain.

La Palma

No professional archaeologists have conducted excavations near the Carrillo Road. Despite this, I am certain the Carrillo Road is not a reutilized pre-Hispanic road given the detailed historical account of its construction, its distinctly historic style, and its lack of linearity. That being said, I was not surprised when I hiked along a lengthy section of the Carrillo Road and did not observe any archaeological material beyond the occasional modern litter. However, after consulting with Myrna Rojas during a visit to MNCR, I learned of the La Palma site (SJ-501 LP). It turns out the construction of the Carrillo Road bisected La Palma, a site that once featured mounds and a pre-Hispanic cobble-paved road, located to the northwest of San Jerónimo de Moravia.

Interesting enough, José Fidel Tristán (1874-1932), the son of the Tristán contracted to build the road with Keith and Fernández, was passionate about archaeology from an early age and kept a diary where he carefully registered his archaeological explorations. On January 22, 1922, Tristán wrote in his diary, “My father told me that, when he was constructing the cart road

to Carrillo in 1882, he saw various circles of stone and numerous fragments of pots and grinding stones in the road path between San Jerónimo and Ascensión Vargas' farm²⁴” (my translation of Tristán 2007:64). This brief description is reminiscent of the common site plans found at archaeological sites in the Central Region from the beginning of the El Bosque/Pavas Phase to the Colonial Period.

Influenced by the methodologies of C. V. Hartman, José F. Tristán was an important pioneer in Isthmo-Colombian archaeology (Tristán 2007:i) even though he only published three short reports of his investigations (Tristán 1922, 1924, 1925) and never had formal training in archaeological method and theory. After being associated MNCR for many years as a zoologist, Tristán became museum director for a brief period from March 1930 to his death in January 1932 (Tristán 2007:ii).

Jose F. Tristán visited La Palma several times from 1913 to 1931 and wrote about his observations and findings in his diary. His documentation of a stone paved road, referred to by the locals of his time as “El Camino de los Indios,” is important to the present investigation (Tristán 2007:64-65, 109). He sketched a basic map of the features he observed (Figure 23). This map and Figure 24 show the relationship between the Carrillo Road and the pre-Hispanic road of La Palma as well as the general locations of several cemeteries Tristán identified (Tristán 2007:65). Tristán described the intersection of this road with the Agrá River, labeled in the figures 23 and 24 as a pass, as being characterized by a series of stone steps that were already in poor condition in the early 20th century (Tristán 2007:64). Tristán's map does not include any of

²⁴ “Mi padre me refirió que cuando él contruía la carretera a Carrillo en el año 1882, vio en el trayecto comprendido entre San Jeronimo y la finca de Ascensión Vargas, varios círculos de piedra y numerosos fragmentos de ollas y piedra moler” (Tristán 2007:64).

the mounds his father mentioned observing in 1882. Perhaps the stones from features at La Palma were mined for use in the construction of the Carrillo Road.

Using this hand-sketched map, UCR graduate student Marco Arce and I located La Palma (SJ-501 LP) in July 2010. First, we carefully walked the eroding ditches along the now paved portion of the Carrillo Road in search of any pre-Hispanic refuse. We observed non-diagnostic sherds and several fragments of flagstone. Next, we spoke to local residents along the Carrillo Road with the boundaries of the site. We received permission to photograph several private artifact collections consisting of pieces found nearby, and maybe from La Palma. We received permission from the owner of the lot that should contain the remains of the road Tristán described allowed us to conduct a quick field walk (or transect) reconnaissance. Arce and I were not able to locate the road at La Palma, but we were able to locate the location on the landscape where it appeared to have been according to Tristán's map. We did not observe any features on the surface, but we did notice some flagstone barely visible beneath a field. During our two visits to La Palma, we photographed all the diagnostic ceramic sherds and lithic artifacts we encountered on the surface. These cultural remains, including Tayutic Incised, Papagayo Polychrome, Curridabat, and Early Cartago sherds, help date the occupation of La Palma to between A.D. 500 and 1500.

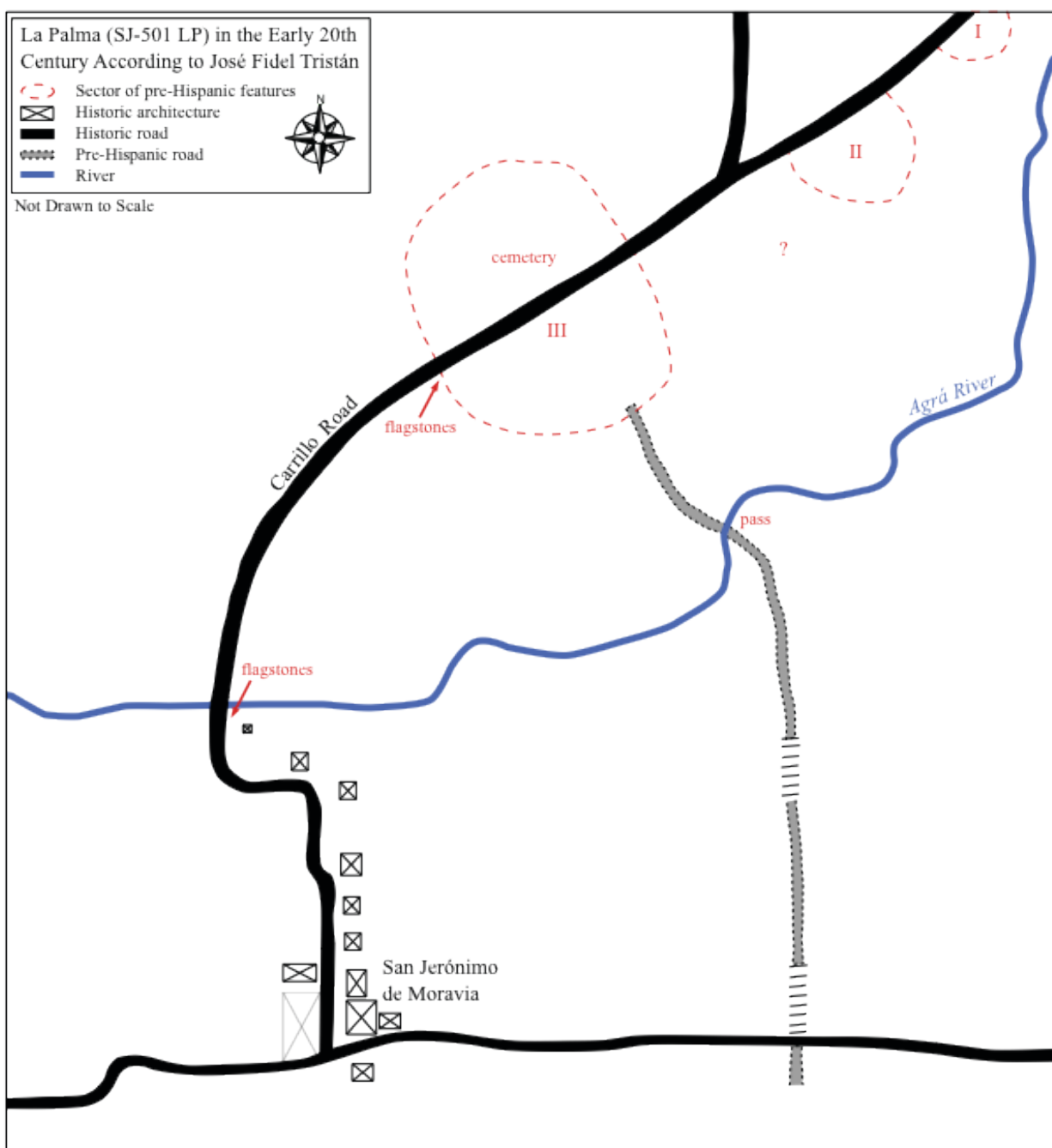


Figure 23. Amateur archaeologist José Fidel Tristán visited La Palma (now SJ-501 LP) several times from 1913 to 1931. This map is based on the sketch he drew of the site indicating the locations of the road, cemetery, and some flagstones (redrawn after Tristán 2007: 65, not drawn to scale).



Figure 24. All red lines and labels indicate the approximate locations of features located at La Palma (SJ-501 LP) observed in the field and deduced from Tristán's map. The road at La Palma is visible in the 2010 Google Earth imagery and represented here by a solid red line.

Later, while observing La Palma in Google Earth imagery dating to 2010, I noticed an interesting linear feature near where the road should be. This feature is indicated in Figure 24 by a solid red line. This figure also depicts the approximate locations of the features Tristán included in his map. A survey of La Palma is needed to determine the site's true area and the impact that modern development and land use practices are having on the preservation of the site.

It is impossible to say if La Palma has any meaningful relationship to the hypothesized interregional landscape of movement I am investigating. However, I have included my report on La Palma in my thesis, because it adds to our growing dataset of sites with identified landscapes of movement. A most speculative interpretation of La Palma is that its road provides evidence that the La Palma Depression might have functioned as an interregional landscape of movement, because it is located on the opposite side of this natural pass from Nuevo Corinto and features a road with a projected trajectory toward Bajo de la Hondura. However, there remains a distance of more than twenty-five unsurveyed kilometers between these two sites.

Summary

In this section, I have presented the archaeological evidence for an interregional landscape of movement between the La Unión District and the population centers of the Central Highlands. In the La Unión District, our knowledge of the roads, trails, and paths used by late pre-Hispanic peoples remains concentrated on the immediate surroundings of the sites of Nuevo Corinto and Las Flores. By studying the trajectories of these routes along with our knowledge of the features they might have connected to, I discern that these routes lead first to cemeteries and then to locales farther away. Yet, I am not able to state exactly to where these landscapes of movement lead. Were they only have served local purposes or might they prove to have connected to more distant sites beyond the district?

The sites of Pava Negra and Cerro El Coronel offer evidence that people occupied the intermountain region during the periods I am interested in. However, we still do not know if these sites were directly associated with or would have had reason to be connected with the communities of Nuevo Corinto and Las Flores. La Palma is located too far away from the La Unión District to make any argument that its inhabitants would have been in direct

communication with Nuevo Corinto via a pre-Hispanic version of the Carrillo Road through the La Palma Depression. The direct archaeological evidence for such a route has not been recovered.

The superficial archaeological reconnaissance I conducted was not sufficient to elucidate which route through the mountains would have been used by the inhabitants of the La Unión District to communicate and trade with the communities of the Central Highlands. With such a large study area that includes much terrain unknown to archaeologists, regional surveys are the only way to obtain enough information about late pre-Hispanic settlement and land use patterns to better predict which possible route would have been used for interregional communication and trade. Perhaps, using the GIS LCPs and LCC analyses to interpret the topography and determine the optimal routes of human movement will provide us a starting point, a corridor or valley to survey first in the search for evidence of its use as a pre-Hispanic landscape of movement.

Optimal Landscapes of Movement: LCPs and LCCs

The dynamic topography of towering volcanoes and the contrasting precipitous slopes and steep canyons descending to rapid rivers influenced how the populations of the La Unión District and the Central Highlands moved across the Cordillera Central to communicate with each other. Based on the predicted velocity a human can walk across every 90 square meter block of land, I derived the most advantageous paths that a human could choose between Nuevo Corinto and each of three contemporaneous population centers: CENADA, Agua Caliente, and Alto de Cardal. Figure 25 depicts these three different routes over a hillshade model of the topography. Each optimal route is a probable option to reach the given destinations and, with small variations, most other destinations in the Central Highlands.

The optimal route between Nuevo Corinto and CENADA, located in the Central Valley, follows the General River upslope through the Desengaño Depression between the volcanoes Poas and Barva. The optimal route to Agua Caliente, located in the Cartago Valley, passes through the La Palma Depression along the Hondura River between Barva Volcano to the northwest and the volcanoes Turrialba and Irazú to the southeast and south, respectively. The optimal route to Alto de Cardal, located on the southwestern slope of Irazú Volcano, goes almost directly south along a ridge between the Corinto and Costa Rica rivers. This route then passes along the northwestern edge of the crater of Irazú and then continues down slope until it reaches the site.

These routes are optimized predictions of where a person would walk and do not reflect actual human behavior. The historic road data, when compared to these optimal routes, demonstrate that the least cost path analyses produced relatively accurate predictions of historic human movement (see Figure 26). In fact, Minor Keith and his crew paved the La Palma Depression portion of the Carrillo Road along the optimal route from Nuevo Corinto to Agua Caliente. The historic route from Barva to Santa Clara was probably located to the north of the optimal route, as I have it depicted. Pre-Hispanic populations might not have moved along these optimal routes, but they suggest locations to conduct archaeological reconnaissance and survey in the future.

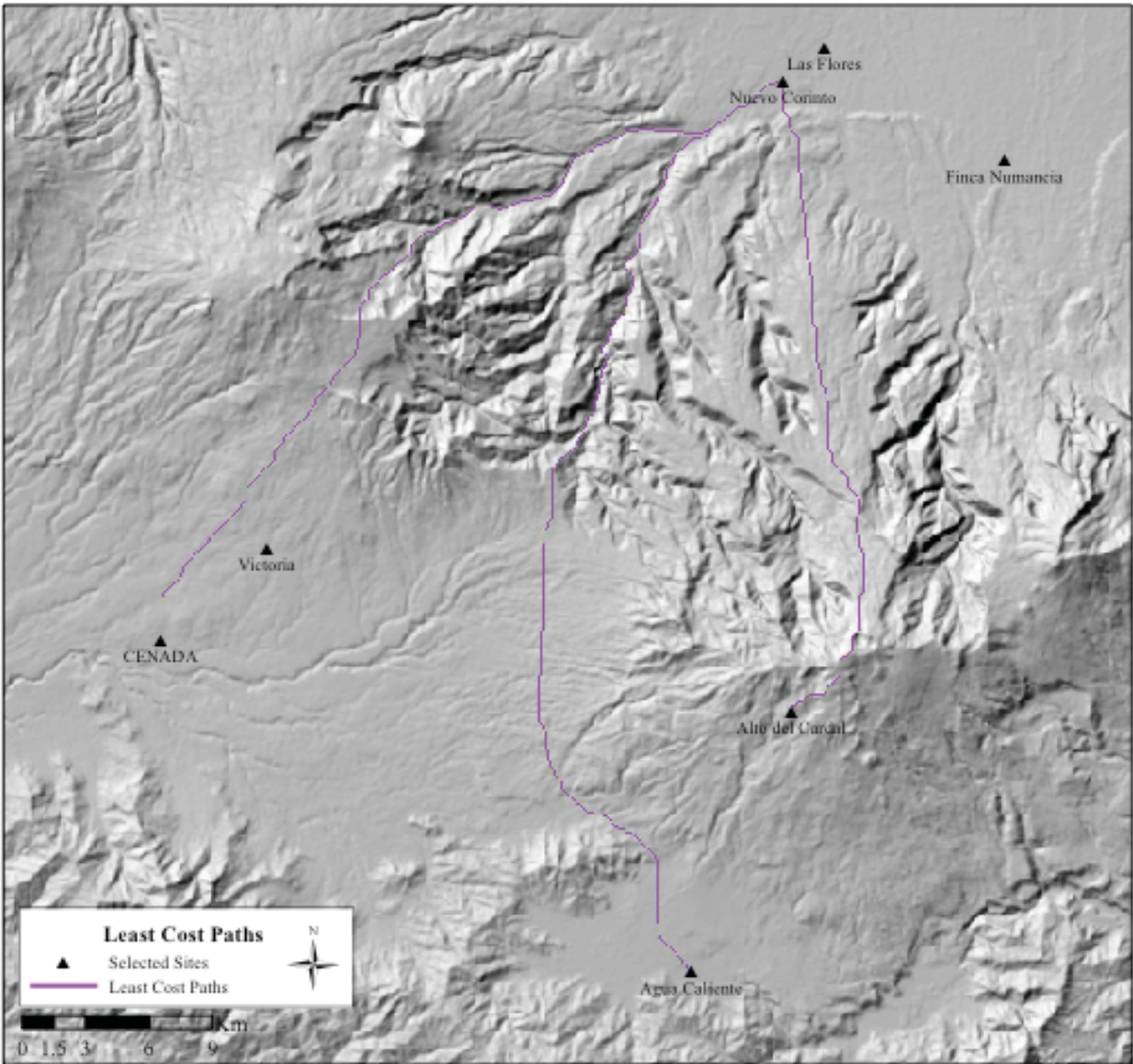


Figure 25. Least Cost Paths between each of the late pre-Hispanic population centers CENADA, Agua Caliente, and Alto de Cardal demonstrate that optimally, the inhabitants of these sites would have used distinct routes to communicate and trade with each other.

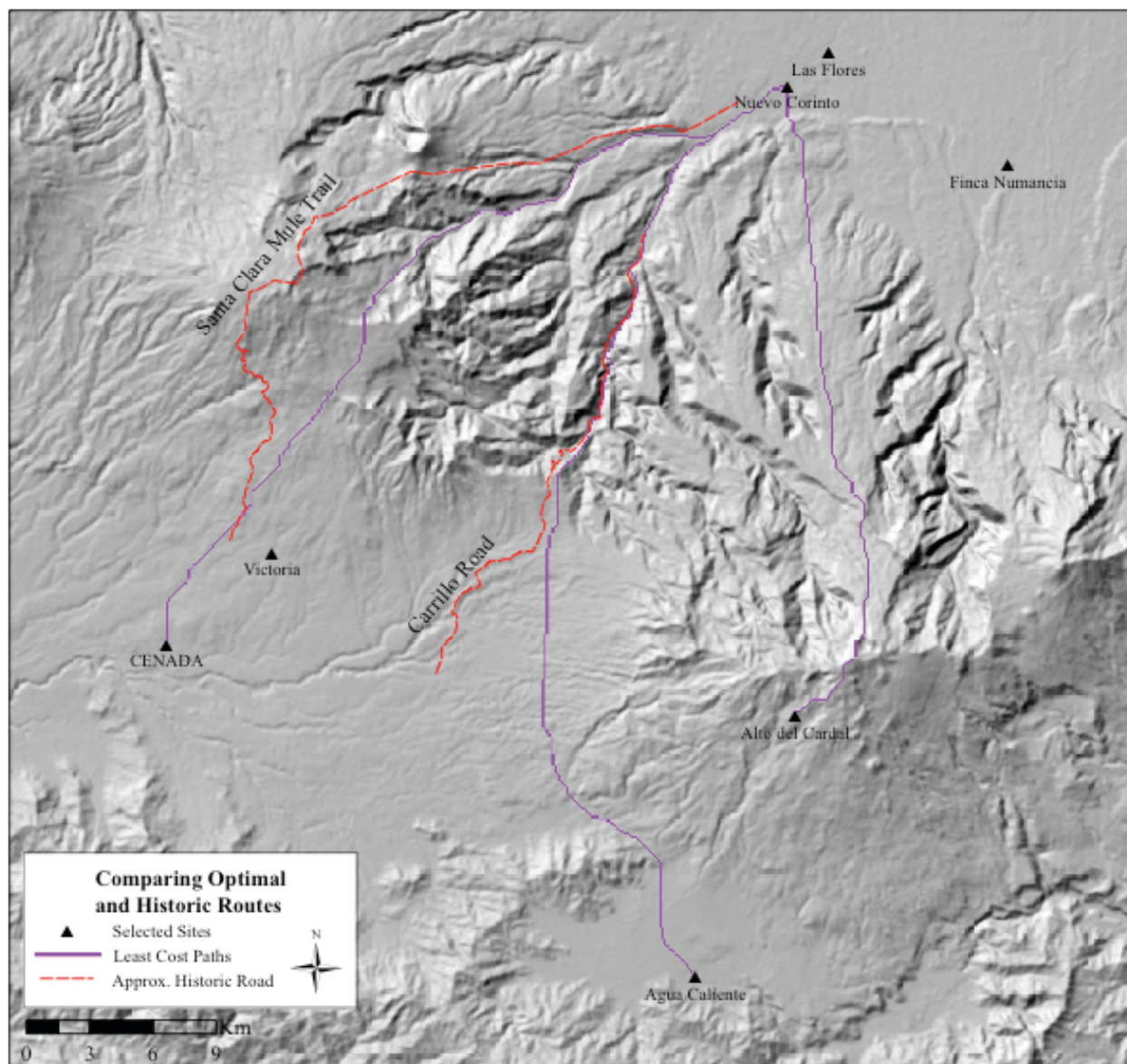


Figure 26. Comparing the optimal and historic routes reveals that the Carrillo Road followed the optimal route through the La Palma Depression, while the historic route from Barva to Santa Clara went farther north than the optimal route to pass by Poas Volcano.

More easily, these populations might have communicated with each other along one primary route. To determine what this route, I conducted a least cost corridor analysis among the habitation sites of Nuevo Corinto, Cubujuquí, CENADA, and Agua Caliente. As you can see in

Figure 27, the LCC shows that the La Palma Depression is the geographic corridor most optimal considering communication from the sites I have included in my analysis. Whereas different origins and destinations can result in different LCPs, an LCC determines what route would have made the most sense to the inhabitants of the sites and their surroundings given that topography and sharing a common path through the mountains were important factors. Different from the LCP analyses, the LCC raster allows for interpretation of other possible routes that are less optimal. In map, any route within the terrain with a cost unit of 3000 or below could have served as a reasonably efficient route. Both the Desengaño and La Palma depressions are included this area.

Considering the results of all LCP and LCC analyses, I have not proved or disproved my hypothesized routes. Yet, I have provided substantial evidence that the movements of late pre-Hispanic was channeled through either the Hondura River Valley of the La Palma Depression or General River Valley near the southern edge of the Desengaño Depression. Key to the interpretation of the LCP and LCC results is the fact that I was not able to incorporate the cultural factors that influence movement into my dataset. Because of this limitation, the LCC analysis provides the best prediction of human movement because it provides a range of terrain for future researchers to investigate. Identifying this range substantially narrows the archaeological search for landscapes of movement through the Cordillera Central. Despite this limitation, these results provide a starting point to guide future research on human movement throughout the Central Region and the rest of the Isthmo-Colombian Culture Area.

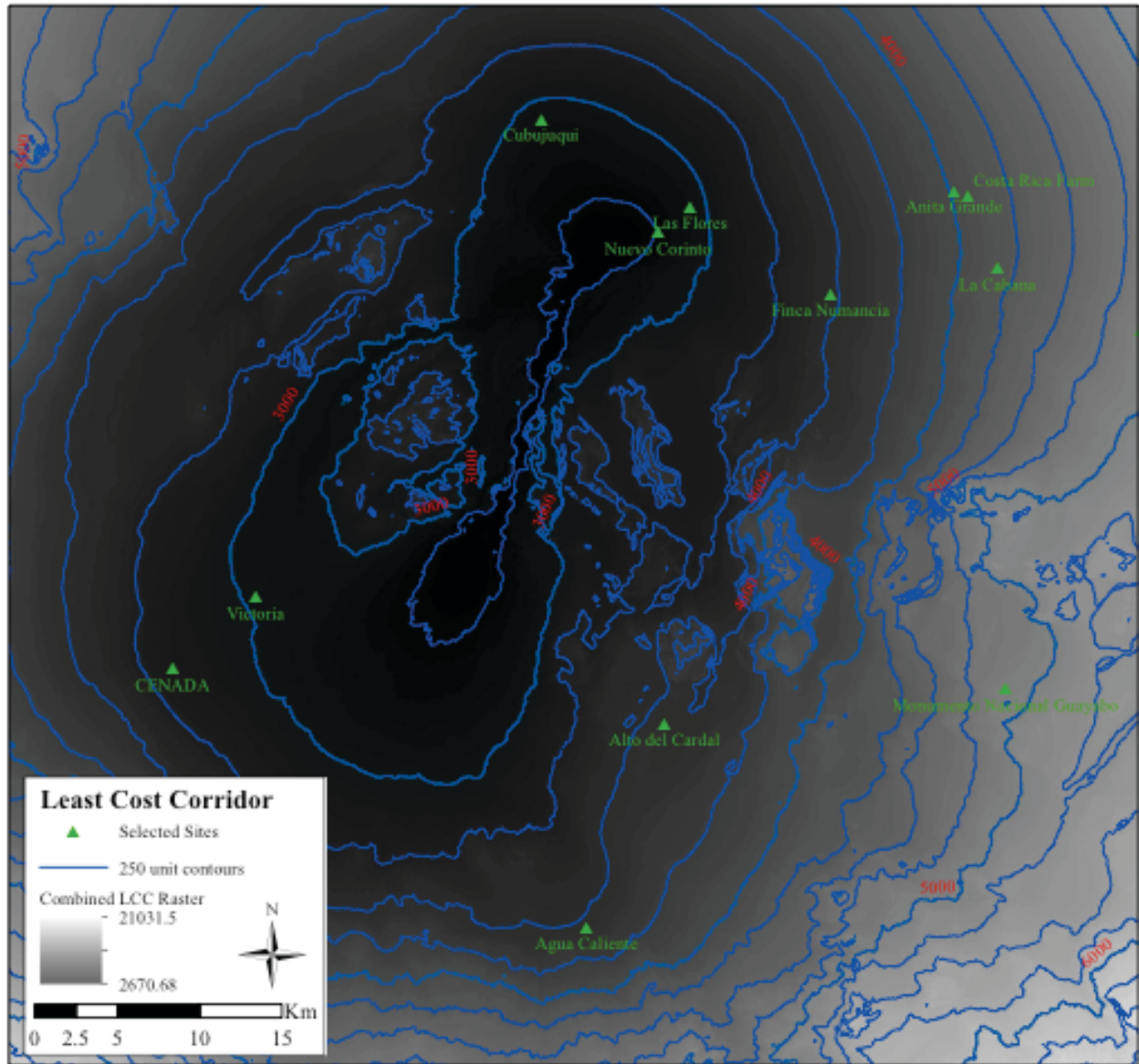


Figure 27. The least cost corridor analysis shows that either the La Palma or Desengaño depressions could have facilitated transportation and communication among the inhabitants of the northeastern Caribbean Lowlands and the Central Highlands.

Final Interpretations: A Glimpse into the World-System

Interactions and exchanges within the Circum-Caribbean World-System occurred along the network of movement. While world-systems theory originally explained the development of

the highly interconnected modern world economy, Orser (2009:253) characterizes this theory as “a set of concepts and approaches that permits the study of large networks of human interaction over broad spaces.” Thus, I use world-systems theory for its vocabulary, interpretive framework, and ability to generate testable hypotheses about interregional interaction and exchange within the network of movement. In this section, I employ a world-systems perspective to analyze, describe, and compare the evidence for pre-Hispanic interregional landscapes of movement through the Cordillera Central within the context of the known archaeological record. These analyses and interpretations bring light to the functions and properties of the specific landscapes of movement, while hinting at the scale of the entire network of movement.

World-systems theory concepts (e.g., cores, semi-peripheries, and peripheries) link social change to interregional competition among populations of unequal power. This relationship is exemplified when Schneider (1991:45-46) emphasizes the role of “differentiation, division of labor, and interdependence” to mobilize resources within the system. This character of world-systems theory is potentially problematic when applied to the Central Region of the Circum-Caribbean World-System.

Different from other world-systems, numerous sociopolitical cores comprise the Circum-Caribbean World-System. Based on the present knowledge of the Central Region, none of the population centers had substantially greater socio-political influence over the others. The entire Central Region, as with the rest of the Isthmo-Colombian Area, was politically organized into chiefdoms or complex-tribes (Habicht-Mauche et al. 1987; Hoopes 1988). Building off of Hoopes’s (2001) interpretations, these chiefdoms/complex-tribes were diffusely united mini-systems that interacted and exchanged goods and ideas in the series of segmentary lineages that constituted the local and regional network of movement. These diffusely united mini-systems

were characterized by a “short-term fission-fusion structure” and “loose and fluid affiliations” (Hoopes 2001:4). These characteristics produced long-term sociopolitical stability throughout the cultural area.

In a diffusely united region, it is a challenge to distinguish between cores and semi-peripheries. Sites may have held these roles in the world-system for short periods. Interpreting the long-term pattern of route connectivity has potential to reveal the differences between these village types. The cores of the world-system, while not equated to state-level societies, do constitute the political and economic structural framework of the world. By identifying the cores, the important sociopolitical centers, in the Central Region and how they related to one another, we can begin to delineate the boundaries of the chiefdoms and complex tribes that politically organized these people during the late pre-Hispanic period. The extent of the local network of movement reveals these boundaries and provides the best information about the organization of sites of the Central Region. Landscapes of movement reveal that sites such as Guayabo, Las Mercedes-1, and Cutris were cores in the Central Region during the late pre-Hispanic Period. My research reveals that Nuevo Corinto and Las Flores also constituted a core in the La Unión District.

The inhabitants of Nuevo Corinto and Las Flores were a people maintaining a central role in the mobility of goods and information between the Caribbean Sea and the Central Valley. The Central Valley was a particularly important geologic landscape feature to access. First of all, the Central Valley mediated and facilitated communication between the Caribbean and the Pacific. Additionally, the Central Valley, as it is today, was one of the most populated subregions in the country. Furthermore, it contains highly fertile soil on well-drain land (Arias Quirós 1984:47). Strategically located in the alluvial fans past the northeastern edge of the Cordillera Central,

Nuevo Corinto and Las Flores controlled access to the terrestrial routes through the Cordillera Central and the Chirripó River, a primary fluvial mode of transportation.²⁵

The archaeological evidence indicates that Nuevo Corinto and Las Flores constituted two halves of one important sociopolitical, commerce, and communication core. I interpret Nuevo Corinto and Las Flores together, because these sites appear to have housed the same people as one community. A short road (Road A) facilitated rapid communication between these clusters of architecture we label *sites*. I suspect future research will solidify the unity of these sites and reveal the particular functions of their distribution. Perhaps Las Flores served as an inland port for canoe travelers on the Chirripó River, while Nuevo Corinto was the protected inland habitation and activity area.

The indication that these sites form a core is not absolute. The evidence indicates that the most traveled roads at these sites passed through rather than converged on these sites. So far, we know that the roads in the La Unión District connected the architectural centers to cemeteries and resource locales. As sociopolitical centers, we expect cores to serve central roles in the network of movement. However, we do not have evidence of a site with many roads converging on it in this region other than Cutris. Based on the pattern of the known roads and paths, Nuevo Corinto and Las Flores could be semi-peripheral nodes in a larger political structure.

The diffuse unity of the Central Region is important to consider when thinking about Nuevo Corinto and Las Flores within the larger world-system. If Nuevo Corinto and Las Flores were two sides of the same core, we do not have evidence of many peripheral settlements surrounding them. Then again, there is not much evidence in this region that cores exerting long-lasting power outward to numerous peripheries either. Until archaeological evidence proves

²⁵ I predict that future research will reveal evidence of the navigability of the Chirripó River.

Nuevo Corinto was not part of a core, I assume it maintained the role as the central node in the local La Unión District network of movement as a core.

The cores of world-systems connected with each other through their peripheries, which acted as buffers. Possibly smaller settlements like El General, Cubujuquí, and Finca Numancia were peripheral to Nuevo Corinto and Las Flores, but we do not have evidence to substantiate such a relationship. The most common sites surrounding Nuevo Corinto are cemeteries. World-systems terminology cannot be used to interpret the cemeteries and resource locales (like queries), yet these sites also affect the direction and purpose of movement.

When determining the scale of the network of movement from the perspective of Nuevo Corinto and Las Flores, it is crucial to recognize these sites' cultural association/relationship within the Central Region. The evidence for cultural continuity in the Central Region comes from the ethnohistoric and archaeological documentation of settlement, mortuary, and subsistence patterns, as well as the style and decorative technique of worked stone and ceramics (Arias Quirós 1984). The spatiotemporal extent and degree of this cultural continuity is not concrete, but the evidence from sites dating to the late pre-Hispanic indicate the inhabitants of this region participated in one culture even though geographic barriers separated them. Roads, trails, and paths, are integral components of cultural systems. Without these features, a people would be isolated from the resources they need and the information they desire. Without these features, human interaction and cultural continuity across this broadly spaced region would not be possible.

According to Chase-Dunn and Hall (1997) world-systems have at least four different boundaries relating to different levels of interregional interaction in (1) bulk goods networks, (2) political-military networks, (3) luxury or prestige good networks, and (4) information networks. I

listed these networks in order from smallest to largest. Since information networks are not as easy to identify from the archaeological record, I determine that the scale of the network of movement at its height must have reached as far as evidence of the prestige goods in the material record indicate. The refuse we recovered in excavations at Nuevo Corinto thus far contains the remains of artifacts imported from other districts in the Central Region and Greater Nicoya Subarea. However, more research may reveal that the landscapes of movement associated with the La Unión District were part of the network of movement that gave the Central Region access to information, prestige goods, and resources from districts of Mesoamerica, the Caribbean Islands, Northern South America, and the Central Andes.

Taking a singular function approach would not do justice to the complexities of the societies that used the network. While some networks of movement serve one societal function, most are multifunctional. Earle (2009:255) emphasized this point when he noted that humans mobilize to procure resources, trade goods, socialize, wage wars, and participate in ceremonies, among other reasons. However, each route does not serve all functions. Consequently, there are multiple overlapping networks of movement within a world-system, each serving a particular combination of functions to their societies. Since more traffic is provincially concentrated than interregionally extended, more landscapes of movement serve local functions than interregional functions. The La Unión District was no exception.

Material culture in the La Unión District provides the most information about long-term, on-going cultural continuity. This material culture also reveals the functions and properties of the network of movement. Because non-perishable items, like stone tools and ceramics, are common in the archaeological record, they provide the best evidence for route functions. Due to the limited information available, the trade and procurement of non-perishable items constitute the

obviously indicated functions of interregional interaction and exchange. This explains why the largest observable network of movement in the archaeological record is the network that facilitated the trade of prestige goods.

Thus, the primary function of the macro-scale interregional network of movement was to connect Nuevo Corinto and Las Flores with the larger world-system. In the Isthmo-Colombian Area, these interregional networks permitted cultural continuity through the dissemination of information and goods across a diffusely united sociopolitical landscape. At the local level, the inhabitants of the villages in the La Unión District used the landscapes of movement for multiple functions. They used the paths to procure resources like construction materials and food. Additionally, the roads and paths served ceremonial functions. The cemeteries in route from the primary habitation sites indicate an importance of moving through, to, and from funerary spaces.

Along the road(s) from Nuevo Corinto to the Central Valley, merchants mobilized commodities, runners disseminated information among cores, genes flowed, wars were battled, treaties were made, alliances were formed, ideas moved, and ceremonies occurred. Until we conduct more research at these sites, the exact functions of these roads remain untested. The analysis of the directly associated material record has potential to indicate the particular functions of each route. To relate the middle range processes of local and interregional human movement to macro-scale processes, I use world-systems theory. Other theories might be better suited for the interpretation of these features. In the process of my research, I have decided that network theory is a viable alternative theory. My analyses using world-systems theory suggest that Nuevo Corinto and Las Flores were cores in the diffusely united Central Region and that human movement from these sites had multiple functions.

Summary

The archaeological record indicates cultural continuity throughout the Central Region during the late pre-Hispanic Period. Only a well-established network of movement could maintain such broadly distributed cultural continuity. While the totality of the landscape(s) of movement that connected the people of La Unión District to their neighbors in the Central Valley remains undetermined, the archival and archaeological evidence substantiate a route or routes existed. Without concrete evidence of a road or trail through the Cordillera Central I cannot determine exactly how and where these people moved across the landscape. However, least cost path (LCP) and least cost corridor (LCC) analyses provide optimized estimations of how people moved between population centers across the topography of the Cordillera Central. This GIS-based data validates the possibility that the historically used routes through the Hondura Valley of the La Palma Depression and the El General Valley of the Desengaño Depression could have been used in pre-Hispanic times, if optimal walking velocity was a primary factor influencing the way these people moved across the landscape. No matter what route they used, a world-systems analysis of the archaeological record helps identify that these features served a range of functions from interregional communication to local resource procurement to and from the communities of Las Flores and Nuevo Corinto. These late pre-Hispanic villages were an integral component of the Línea Vieja Subregion as either a core or an important semi-periphery. This subregion of the Central Region communicated with other populations throughout the Circum-Caribbean World-System by way of the network of movement.

CHAPTER 6: CONCLUSIONS

Before the arrival of the Spanish, the Costa Rican landscape featured a complex adaptive transportation system of stone-paved roads, paths, trails, navigable rivers, and maritime routes. These networks facilitated the movement of people, luxury/prestige goods, bulk goods (e.g. food and supplies), information, symbols (e.g. iconography), genes, diseases, and other forms of communication, trade, and exchange among populations. As the indigenous population decreased in number and the social organization of the country changed to accommodate Spanish needs, many of these routes were either altered or forgotten while others were adopted for use during historic periods. Recent fieldwork at Nuevo Corinto and preliminary analyses of the artifactual remains strongly suggests that this site was interconnected to its surrounding settlements and cemeteries in the La Unión District, and, to a larger scale, the Línea Vieja Subregion of the Central Region, through a local network of movement.

A millennium ago, sometime between A.D. 900 and A.D. 1500, the villages and hamlets in the La Unión District of the northeastern Caribbean Lowlands of Costa Rica were participating in the distribution of material goods and information along a network of movement. In the less than 600 years since the demise of the villages of Nuevo Corinto and Las Flores, the roads, trails, and paths these people used have either eroded away or are shrouded in sediment and vegetation. Using a multiple-method approach, I proceed from the known archival record of roads and trails to the unknown pre-Hispanic landscapes of movement.

The archival record did not reveal a history of human movement through the Cordillera Central until the middle to late 19th century. At this time, the search for a route to the Caribbean from the Central Valley began. Two of those routes crossed through the Cordillera Central. The first documented route was a mule road leaving from Barva that followed the General River of

the Desengaño Depression until it reached the community of Santa Clara. The other major route was the Carrillo Road, built as a stone-paved cart road to facilitate the movement of commodities and people between the capital city and railroad town of Carrillo through the Hondura Valley of the La Palma Depression. From Carrillo, the passengers and cargo would travel through the heart of the Línea Vieja Subregion on the namesake railroad to Puerto Limon on the Caribbean Coast. A direct historical approach indicates that either or both of these routes might have roots in the pre-Hispanic Era, but the three century long expanse that is bookended by the abandonment of the La Unión District sometime before 1550 and the 19th century inaugurations of these routes is too much to posit a direct relationship or any continuity in route use without additional evidence.

My interpretation of an interregional road through the Cordillera Central remains tentative on the basis of limited archaeological evidence. The observed cultural continuities that spanned the Central Region during the late pre-Hispanic Period suggest that the populations of these areas communicated and traded with regularity. Such regular communication requires an extensive network of movement across the Cordillera Central among other geographic features. The known pre-Hispanic landscapes of movement in the La Unión District extend out from the architectural clusters of Las Flores and Nuevo Corinto, gradually becoming undetectable. This has been the case with landscape of movement features across the Central Region. The diligent research of Ricardo Vázquez (Vázquez Leiva 2006b; Vázquez Leiva and Chapdelaine 2008; Vázquez Leiva et al. 2003; Vázquez Leiva et al. 2002) and other Costa Rican archaeologists (Cavallini Morales 2011; Gutiérrez González and Mora Sierra 1988; Peytrequín Gómez 2009; Sánchez 2005; Troyo Vargas and Guerrero Miranda 1998) is resulting in a more detailed map of the landscapes of movement throughout this region. We now know enough about the formalized landscapes of movement to be able to discern the pattern of the regional network of movement as

it was at the end of the late pre-Hispanic period. However, in order to do this, we are forced to intuit the connections among roads and trails through tracts of land where they have not yet been detected.

While we cannot readily identify all the segments of the postulated network of movement, we can hypothesize their trajectories using least cost path and least cost corridor analyses in a GIS. I tested this method in my study area and produced intriguing results that revealed a direct correlation between the optimal and historical landscapes of movement with late pre-Hispanic population centers as the origins and destinations of movement. These optimal paths and corridors do not prove pre-Hispanic use, but indicate regions that should be surveyed in search of pre-Hispanic features. The reported existence of Cerro El Coronel habitation site near the optimal and historical paths and about half way between Nuevo Corinto and La Palma suggest that some derivation of the Carrillo Road might have existed during the pre-Hispanic Era. Little to no archaeological investigation between the Barva and Cacho Negro volcanoes means that there is no archaeological evidence of the hypothesized pre-Hispanic landscape of movement analogous to the Santa Clara mule trail.

With only a small proportion of the network of movement known, I use world-systems theory to interpret my findings in the accepted late pre-Hispanic cultural context to discern the scale, properties, and functions of the network of movement from the perspective of Nuevo Corinto and Las Flores. The network of movement was as far-reaching as the material record indicates. Presently, I can say that it extended at least as far as districts in the Greater Nicoya Subarea and included all of the subregions of the Central Region, but likely extended further in all directions. This network was multifunctional and multilayered, meaning that not every route

served every possible function. The observed landscapes of movement served ceremonial, commercial, transportation, and communication purposes, among others.

By the late pre-Hispanic period, the villages of Nuevo Corinto and Las Flores had become two halves of a core in the Línea Vieja Subregion of the Circum-Caribbean World-System. The peripheries of this core are not yet determined, but might include El General, Cubujuquí, and other small habitation sites. Due to the diffuse unity of the Central Region, it is composed of a plethora of mini-systems each with their own cores and peripheries and all connected in one network of movement.

Greater Significance/Implications

My thesis contributes to the growing body of scholarship on the pre-Hispanic cultural landscapes of the Isthmo-Colombian Area. The multiple-method approach in combination with a world-systems analysis has produced a deeper understanding of how pre-Hispanic populations of Costa Rica communicated across such daunting geographic barriers as the Cordillera Central. By proceeding from the known to the unknown, I have reduced the possibilities of human movement to a few possible routes. This same approach can be replicated and expanded upon in other study areas in any region of the world to discern the locations, functions, scales, and properties of networks of movement to understand past patterns of human mobility. This thesis provides a multifaceted methodological approach researchers interested in past human movement might apply to discern landscapes and waterscapes of movement among any number of sites and geographic regions in any time period and across the millennia. Through the investigation of roads and paths in the Central Region I have made steps toward an understanding of these culture's social, political, and economic organization during the late pre-Hispanic Period.

Recognizing past patterns of human movement has potential to answer many questions about culture change.

I have initiated the development of a world-systems analysis of the non-state societies of the Central Region of the Isthmo-Colombian Area by applying the concepts of world-systems theory to the study of roads, trails, and paths, the archaeology of travel, among diffusely united communities. This is a situation where the determination of cores, peripheries, and semi-peripheries in the archaeological record is not clear and concentrated research is required.

Future Research

My thesis has outlined a methodological program to study human travel by foot across land in protohistoric times. With adjustments, my multiple-method approach can be applied to other modes of transport and/or deeper into time. There is a great need in archaeology today to understand the processes of past human movement and the role this mobility served in the dissemination and interchange of cultural material and information. Expansive cultural continuities and similarities denote expansive interactions and exchanges that necessitate research at the local, regional, and areal levels. I contribute to this line of research by developing a multiple-method program that I hope is flexible enough to be expanded upon and widely applied elsewhere.

In my study area, future research needs to analyze movement in other directions from Nuevo Corinto, in surrounding regions, between more contemporaneous sites, and by waterscapes. By combining the knowledge of the factors influential to past patterns of human movement revealed in the study of the footpaths in the Arenal District with ethnographic studies and settlement pattern analyses we can improve the accuracy of least cost path analyses in the Central Region and elsewhere. My study functioned to establish a methodological process to

study human movement with the available datasets and additional inexpensive research. However, I only preliminarily analyzed movement in one direction. Ultimately, if we are to understand the macro-level processes of human movement across the Central American Isthmus and beyond, we need fine-grained understandings of the settlement patterns, landscape use, and interregional relationships of these peoples.

We can begin to build this understanding by applying the methodology I have outlined to other study areas in the Central Region and the Isthmo-Colombian Area. For example, least cost path and least cost corridor analyses from the ends of identified and mapped road and path segments at sites all across the Caribbean Lowlands will help us construct a road map of the inter-site connections of the late pre-Hispanic. Once produced, these optimal predictions will need to be groundtruthed by surveys. Nonetheless, discernable regional network of movement can be expanded upon.

Future excavation of the pre-Hispanic road segments may be successful at collecting datable material in context. The exact functions of the landscapes and waterscapes of movement cannot be determined until a detailed understanding of the functions of features directly associated with the network of movement features is obtained. At Nuevo Corinto, we do not know the past functions of the plazas and mounds the roads connected to. We can speculate that the plazas were market places, ceremonial spaces, or ball courts, but, to date, we really do not know. In addition to excavation, surveys of the surrounding landscape of the La Unión District is essential to reveal what the roads and paths led to and to begin to understand why. If and when other segments of landscapes of movement within the study area are detected, these may be part of the hypothetical route I am tracing and excavating transects of these features would help determine the nature and date of their construction.

While I used world-systems theory to analyze and interpret the network of movement from the perspective of the La Unión District, there are other models of interregional and intraregional interaction that might be better suited to elucidate more about the local-level, district-level, and region-level processes of interaction and exchange. Network theory, is one I have identified that exhibits much potential to provide further insight into the local and regional interactions and exchanges that would have occurred within the society of the pre-Hispanic inhabitants of Nuevo Corinto.

The sites where I conducted reconnaissance need to be further investigated. There are no future plans to conduct fieldwork at the La Palma site, but it is in need of immediate investigation. Google Earth imagery reveals that houses and other structures were constructed over much of the site sometime between 2005 and 2010. To learn as much as we can about this site before it is completely destroyed, archaeologist need to take action. At the very least, the site should be surveyed and mapped. This research would groundtruth the road I identified in the imagery and determine the extent of the site. Additionally, more archaeological reconnaissance is needed in collaboration with PNBC. The territory of the park is so expansive it must contain many more archaeological sites than Cerro El Coronel and Pava Negra. These known sites need further research and more sites need to be identified if we are to understand human movement among other cultural processes in the Central Region.

While the landscapes of movement were an important component of the network of movement, the waterscapes of movement, especially in the Caribbean lowlands, are crucial to understanding how communities were connected, interacted, and exchanged goods and information. My research has not able to address the waterscapes of movement, but I encourage future research to do so. I hope to combine least cost path and least cost corridor analyses with

the drift modeling studies conducted by Callaghan (Callaghan 1999, 2001, 2003a; Callaghan and Bray 2007) and studies of river navigability. This will help with the development of a robust methodology capable of predicting optimal routes between any locations across land, river and sea. Such a methodology would aid studies of long-distance trade and exchange.

The research possibilities are numerous. Let us continue to answer more questions about the pre-Hispanic unknown by building on what we presently know. Let us continue to decipher the lifeways of these people one refuse deposit at a time, all the while reflecting on how these deposits fit into the larger cultural system. This process is ongoing. At present, there are more archaeologists in Costa Rica, Panama, and Nicaragua than ever before. In the coming decades these archaeologists will fit more pieces of the puzzle together, and we will begin to understand more of the pre-Hispanic cultural processes of this portion of the Circum-Caribbean World-System.

GLOSSARY OF ABBREVIATIONS AND UNFAMILIAR TERMS

ANCR – Archivo Nacional de Costa Rica

ASTER – Advanced Spaceborne Thermal Emission and Reflection Radiometer

Back link raster – a raster where each cell contains a value identifying the neighboring cell that is next on the least accumulative cost path from the origin to the destination cell.

BNCR – Biblioteca Nacional de Costa Rica

Cost distance raster – a raster that stores the minimum accumulative cost distance of each cell over a cost surface from the origin to the destination cell.

Cost surface analyses – “the generic name for a series of GIS techniques based on the ability to assign a cost to each cell in a raster map, and to accumulate these costs by travelling over the map” (van Leusen 2002:6-4).

DAH-MNCR – Departamento de Antropología e Historia del Museo Nacional de Costa Rica

DEM – Digital Elevation Model

ESRI – Environmental Systems Research Institute

GIS – Geographic Information Systems

GPS – global positioning system

ICE – Instituto Costarricense de Electricidad

IGNCR – Instituto Geográfico Nacional de Costa Rica

LCC – least cost corridor

LCP – least cost path

MNCR – Museo Nacional de Costa Rica

NAD – North American Datum

PANC – Proyecto Arqueológico Nuevo Corinto

PAPC – Proyecto Arqueológico del Pacífico Central

PNBC – Parque Nacional Braulio Carrillo

Polyline – a polygonal chain or a series of connected line segments.

Raster – a spatial data storage method consisting of a grid of equally sized cells.

Shapefile – ESRI’s geospatial vector data format.

SRTM – Shuttle Radar Topography Mission

UCR – Universidad de Costa Rica

UTM – Universal Transverse Mercator

REFERENCES CITED

- Achio Fuentes, Andrés
2000 Informe de Evaluación Arqueológica Proyecto Hidroeléctrico General. Manuscript on file, Archivo de Investigación, Departamento de Antropología e Historia, Museo Nacional de Costa Rica, San José, Costa Rica.
- Achio Fuentes, Andrés
2007 Los contextos funerarios de la Fase Cartago (900-1550 d.C.) localizados en el sector Playskool del sitio Agua Caliente (C-35AC), Cartago. Unpublished Licentiate's thesis, Departamento de Antropología, Universidad de Costa Rica, Ciudad Universitaria Rodrigo Facio, San José, Costa Rica.
- Acuña Marín, Lesbia, Rossy Isel Alvarado and Federico Solano
2005 Informe final de evaluación arqueológica: Línea de transmisión Proyecto Hidroeléctrico El General. Manuscript on file, Archivo de Investigación, Departamento de Antropología e Historia, Museo Nacional de Costa Rica, San José, Costa Rica.
- Aguilar Bonilla, Mónica and Jeffrey Peytrequín Gómez
2003 Reporte del Sitio Nuevo Corinto (L-72NC). Manuscript on file, Archivo de Investigación, Departamento de Antropología e Historia, Museo Nacional de Costa Rica, San José, Costa Rica.
- Aguilar Piedra, Carlos H.
1972 *Guayabo de Turrialba: Arqueología de un sitio indígena prehispánico*. Editorial Costa Rica, San José, Costa Rica.
- Alfaro González, Anastasio
1893 Arqueología costarricense. In *El Centenario*, pp. 241-246. Vol. 4, Madrid, Spain.
1894 *Antigüedades de Costa Rica*. Tipografía Nacional, San José, Costa Rica.
- Amin, Samir
1974 *Accumulation on a World Scale: A Critique of the Theory of Underdevelopment*. Monthly Review Press, New York, New York.
- Anderson, David G. and J. Christopher Gillam
2000 Paleoindian Colonization of the Americas: Implications from an Examination of Physiography, Demography, and Artifact Distribution. *American Antiquity* 65(1):43-66.
- Arce, Melissa
2005 Descubren red de caminos precolombinos en el Caribe. *La Nación* 17 March. San José, Costa Rica.
- Arias Quirós, Ana Cecilia

1984 Acerca de la unidad cultural entre la Vertiente Atlántica y el Valle Central de Costa Rica. In *Inter-Regional Ties in Costa Rican Prehistory*, edited by Esther Skirboll and Winifred Creamer, pp. 45-58. BAR International Series. Vol. 226, Oxford, England.

Artavia, Betania

2009a Carrillo: El Camino del Destierro del Obispo Thiel. *Diario Extra* 20 February. San José, Costa Rica.

2009b Carrillo: El Pueblo que Desapareció en el Río Sucio. *Diario Extra* 18 February. San José, Costa Rica.

2009c Galletas y Cerveza Llegaron por la Carretera d Carrillo. *Diario Extra* 17 February. San José, Costa Rica.

2009d La Misteriosa Historia de la Ruta 32. *Diario Extra* 16 February. San José, Costa Rica.

2009e Los Misterios de la Boca del Infierno en la Ruta 32. *Diario Extra* 19 February. San José, Costa Rica.

Ascher, Robert

1961 Analogy in Archaeological Interpretation. *Southwestern Journal of Anthropology* 17(4):317-325.

Bailey, Geoff

2007 Time perspectives, palimpsests and the archaeology of time. *Journal of Anthropological Archaeology* 26(2):198-223.

Bauer, Brian S.

1992 Ritual Pathways of the Inca: An Analysis of the Collasuyu Ceques in Cuzco. *Latin American Antiquity* 3(3):183-205.

Bell, Tyler and Gary R. Lock

2000 Topographic and Cultural Influences on Walking the Ridgeway in Later Prehistoric Times. In *Beyond the Map: Archaeology and Spatial Technologies*, edited by Gary R. Lock, pp. 85-100. NATO Advanced Science Institutes series. Series A, Life Sciences. IOS Press, Oxford, England.

Bell, Tyler, Andrew Wilson and Andrew Wickham

2002 Tracking the Samnites: Landscape and Communications Routes in the Sangro Valley, Italy. *American Journal of Archaeology* 106(2):169-186.

Ben-David, Chaim

2002 The Zoar Ascent: A Newly Discovered Roman Road Connecting Zoar-Safi and the Moabite Plateau. In *Limes XVIII: proceedings of the XVIIIth International Congress of Roman Frontier Studies, held in Amman, Jordan (September 2000)*, edited by Philip

- Freeman, Julian Bennett, Zbigniew T. Fiema and Birgittan Hoffman, pp. 103-112. BAR International Series. Vol. 1084. Archaeopress, Oxford, England.
- Benavides Castillo, Antonio
1981 *Los caminos de Cobá y sus implicaciones sociales: Proyecto Cobá*. Colección Científica. Serie Arqueología. Centro Regional del Sureste, Mexico City, México.
- Benzoni, Girolamo
1970 [1578] *History of the New World: Shewing (sic.) His Travels in America, from A.D. 1541 to 1556, with Some Particulars of the Island of Canary*. Translated by Rear-Admiral W. H. Smyth. The Hakluyt Society First Series 21. Lenox Hill Pub. & Dist. Co. (Burt Franklin), New York, New York.
- Beschoner Metheny, Karen
1996 Landscape Archaeology. In *The Oxford Companion to Archaeology*, edited by Brian M. Fagan and Charlotte Beck. Oxford Reference Online. Oxford University Press, New York, New York.
- Binford, Lewis R.
1967 Smudge Pits and Hide Smoking: The Use of Analogy in Archaeological Reasoning. *American Antiquity* 32(1):1-12.
- Blanton, Richard and Gary Feinman
1984 The Mesoamerican World System. *American Anthropologist* 86(3):673-682.
- Bolles, David and William J. Folan
2001 An Analysis of Roads Listed in Colonial Dictionaries and Their Relevance to Pre-Hispanic Linear Features in the Yucatan Peninsula. *Ancient Mesoamerica* 12(2):299-314.
- Braudel, Fernand
1966 *La Méditerranée et le monde méditerranéen à l'époque de Philippe II*. 2nd ed. Lib. Armand Colin, Paris, France.
- Butler, Michelle Marie
2005 Place, Memory and the Ancient Costa Rican Landscape: An Exploration of Footpaths, Cemeteries and Habitation Sites. Master's thesis, Department of Anthropology, University of Colorado, Boulder, Colorado.
- Caldwell, Joseph R.
1964 Interaction Spheres in Prehistory. In *Hopewellian Studies*, edited by Joseph R. Caldwell and Robert Hall, pp. 133-143. Scientific Papers. Vol. 12. Illinois State Museum, Springfield, Illinois.
- Callaghan, Richard T.
1999 Computer Simulations of Ancient Voyaging. *The Northern Mariner/Le Marin Du Nord* 9(2):11-22.

- 2001 Ceramic Age Seafaring and Interaction Potential in the Antilles: A Computer Simulation. *Current Anthropology* 42(2):308-313.
- 2003a Comments on the Mainland Origins of the Preceramic Cultures of the Greater Antilles. *Latin American Antiquity* 14(3):323-338.
- 2003b Prehistoric Trade Between Ecuador and West Mexico: A Computer Simulation of Coastal Voyages. *Antiquity* 77(298):796-804.
- 2003c The Use of Simulation Models to Estimate Frequency and Location of Japanese Edo Period Wrecks Along the Canadian Pacific Coast. *Canadian Journal of Archaeology* 17(1):62-82.
- Callaghan, Richard T. and Warwick Bray
 2007 Simulating Prehistoric Sea Contacts between Costa Rica and Colombia. *The Journal of Island and Coastal Archaeology* 2(1):4-23.
- Carballo, David M. and Thomas Pluckhahn
 2007 Transportation corridors and political evolution in highland Mesoamerica: Settlement analysis incorporating GIS for northern Tlaxcala, Mexico. *Journal of Anthropological Archaeology* 26:607-629.
- Cardale de Schrimppff, Marianne and Leonor Herrera
 2000 *Caminos precolombinos: las vías, los ingenieros y los viajeros*. Instituto Colombiano de Antropología e Historia: Ministerio de Cultura, Bogotá, Colombia.
- Carmack, Robert M. and Silvia Salgado González
 2006 A World-Systems Perspective on the Archaeology and Ethnohistory of the Mesoamerican/Lower Central American Border. *Ancient Mesoamerica* 17(2):219.
- Castro Solera, Max
 2007 Estudio sobre patrones de asentamiento e identificación de caminos prehispánicos y coloniales en el Pacífico Sur de Costa Rica. Unpublished Licentiate's thesis, Departamento de Antropología, Universidad de Costa Rica, Ciudad Universitaria Rodrigo Facio, San José, Costa Rica.
- Cavallini Morales, Carolina
 2011 El camino precolombino del Sitio Arqueológico Alto del Cardal C-304 AC. *Cuadernos de Antropología* 21.
- Charlton, Thomas H.
 1991 The Influence and Legacy of Teotihuacan on Regional Routes and Urban Planning. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 186-197. New Directions in Archaeology. Cambridge University Press, New York, New York.

- Chase, Arlen F. and Diane Z. Chase
2001 Ancient Maya Causeways and Site Organization at Caracol, Belize *Ancient Mesoamerica* 12(2):273-281.
- Chase-Dunn, Christopher and Thomas D. Hall
1993 Comparing world-systems: Concepts and working hypotheses. *Social Forces* 71:851-886.
- Chase-Dunn, Christopher K. and Thomas D. Hall
1991 *Core/Periphery Relations in the Precapitalist World*. Westview Press, Boulder, Colorado.

1997 *Rise and Demise: Comparing World-Systems*. Westview Press, Boulder, Colorado.
- Chase-Dunn, Christopher K. and Kelly M. Mann
1998 *The Wintu & Their Neighbors: A Very Small World-System in Northern California*. University of Arizona Press, Tucson, Arizona.
- Chevallier, Raymond
1976 *Roman Roads*. University of California Press, Berkeley, California.
- Clark, J. G. D.
1951 Folk-Culture and the Study of European Prehistory. In *Aspects of Archaeology in Britain and Beyond: Essays Presented to O. G. S. Crawford*, edited by W. F. Grimes, pp. 49-65. H. W. Edwards, London, England.
- Cobos, Rafael and Terance L. Winemiller
2001 The Late and Terminal Classic-Period Causeway Systems of Chichen Itza, Yucatan, Mexico. *Ancient Mesoamerica* 12(2):283-291.
- Coella Rodríguez, Antonio
2000 El Camino Inca en el Distrito de San Damian (Provincia de Huarochiri) Peru. In *Caminos precolombinos: las vías, los ingenieros y los viajeros*, edited by Marianne Cardale de Schrimpff and Leonor Herrera, pp. 168-193. Instituto Colombiano de Antropología e Historia: Ministerio de Cultura, Bogotá, Colombia.
- Constenla Umaña, Adolfo
1981 Comparative Chibchan Phonology. Ph.D. dissertation, Department of Linguistics, University of Pennsylvania, Philadelphia, Pennsylvania.
- Cooke, Richard
2005 Prehistory of Native Americans on the Central American Land Bridge: Colonization, Dispersal, and Divergence. *Journal of Archaeological Research* 13(2):129-187.

- Cooper, Jago
2010 Modelling Mobility and Exchange in Pre-Columbian Cuba: GIS Led Approaches to Identifying Pathways and Reconstructing Journeys from the Archaeological Record. *Journal of Caribbean Archaeology* Special Publication #3:122-137.
- Corrales Ulloa, Francisco
1992 Investigaciones arqueológicas en el Pacífico Central de Costa Rica. *Vínculos* 16:1-29.
- Corrales Ulloa, Francisco and Maritza Gutiérrez González
1986 Williamsburg: Evaluación de un sitio multicomponente del Atlántico Central de Costa Rica. *Vínculos* 12(1-2):21-38.
- Corrales Ulloa, Francisco and Ifigenia Quintanilla Jiménez
1992 El Pacífico Central de Costa Rica y el intercambio regional. *Vínculos* 16 (1990)(1-2):111-126.
- 1996 The Archaeology of the Central Pacific Coast of Costa Rica. In *Paths to Central American Prehistory*, edited by Frederick W. Lange, pp. 93-118. University Press of Colorado, Niwot, Colorado.
- Davies, Hugh
2008 *Roman Roads in Britain*. Shire Archaeology, New York, New York.
- Departamento de Antropología e Historia del Museo Nacional de Costa Rica (DAH-MNCR)
2012 Orígenes: Base de datos de sitios arqueológicos. Museo Nacional de Costa Rica. Electronic resource, <http://origenes.museocostarica.go.cr/>, accessed March 11, 2012.
- Díaz Bolio, José
1992 *The Magnificent White Roads of Ancient Maya*. Area Maya-Mayan Area, Mérida, México.
- Earle, Timothy
1991 Paths and Roads in Evolutionary Perspective. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 10-16. New Directions in Archaeology. Cambridge University Press, New York, New York.
- 2009 Routes through the Landscape: A Comparative Approach. In *Landscapes of Movement: Trails, Paths, and Roads in Anthropological Perspective*, edited by James E. Snead, Clark L. Erickson and J. Andrew Darling, pp. 253-269. 1st ed. Penn Museum International Research Conference,, Holly Pittman, general editor. University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, Pennsylvania.
- Fenton, William N.

- 1949 Collecting Materials for a Political History of the Six Nations. *Proceedings of the American Philosophical Society* 93(3):233-238.
- 1952 The Training of Historical Ethnologists in America. *American Anthropologist* 54(3):328-339.
- Fernández Guardia, Ricardo
1975 *El descubrimiento y la conquista*. 1st ed. Editorial Costa Rica, San José, Costa Rica.
- Fischer, Moshe, Benjamin Isaac and Israel Roll
1996 *Roman Roads in Judea II: The Jaffa-Jerusalem Roads*. BAR International Series 618. British Archaeological Reports, Oxford, England.
- Fleming, A.
2006 Post-processual Landscape Archaeology: a Critique. *Cambridge Archaeological Journal* 16(3):267.
- Folan, William J.
1991 Sacbes of the Northern Maya. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 222-229. New Directions in Archaeology. Cambridge University Press, New York, New York.
- Folan, William J., Jacinto May Hau, Joyce Marcus, W. Frank Miller and Raymundo González Heredia
2001 Los Caminos de Calakmul, Campeche. *Ancient Mesoamerica* 12(2):293-298.
- Folan, William J., Joyce Marcus, Sophia Pincemin, Maria del Rosario Dominguez Carrasco, Laraine Fletcher and Abel Morales Lopez
1995 Calakmul: New Data from an Ancient Maya Capital in Campeche, Mexico. *Latin American Antiquity* 6(4):310-334.
- Foley, Robert
1981 Off-Site Archaeology: An Alternative Approach for the Short-Sited. In *Pattern of the Past: Studies in Honour of David Clarke*, edited by Ian Hodder, Glynn Llywelyn Isaac and Norman Hammond, pp. 152-184. Cambridge University Press, Cambridge, England.
- Fonseca Zamora, Oscar Manuel
1981 Guayabo de Turrialba and its Significance. In *Between Continents/Between Seas: Precolombian Art of Costa Rica*, edited by Elizabeth P. Benson. Translated by Michael J. Snarskis. Harry N. Abrams, New York, New York.
- 1992 *Historia antigua de Costa Rica: surgimiento y caracterización de la primera civilización costarricense*. 1st ed. Colección historia de Costa Rica. Editorial de la Universidad de Costa Rica, San José, Costa Rica.

Fowler, William R.

2001 Introduction: Special Section: Recent Research on Maya Causeways. *Ancient Mesoamerica* 12(2):259-259.

Frachetti, Michael

2006 Digital Archaeology and the Scalar Structure of Pastoralist Landscapes: Modeling Mobile Societies of Prehistoric Central Asia. In *Digital Archaeology: Bridging Method and Theory*, edited by Thomas L. Evans and Patrick T. Daly, pp. 128-147. Routledge, London, England.

Frank, Andre Gunder

1967 *Capitalism and Underdevelopment in Latin America: Historical Studies of Chile and Brazil*. Monthly Review Press, New York, New York.

1999 Abuses and Uses of World Systems Theory in Archaeology. In *World-Systems Theory in Practice: Leadership, Production, and Exchange. Papers presented at the 94th annual meeting of the American Anthropological Association in Washington, D.C., November, 1995*, edited by P. Nick Kardulias, pp. 275-296. Rowman & Littlefield Publishers, Lanham, Maryland.

French, David H.

1981a *Roman Roads and Milestones of Asia Minor*. Monograph / British Institute of Archaeology at Ankara. British Archaeological Reports, Oxford, England.

1981b *Roman Roads in Asia Minor*. BAR International Series 392. British Archaeological Reports, Oxford, England.

1998 Pre- and Early-Roman Roads of Asia Minor. The Persian Royal Road. *Iran* 36:15-43.

Gerbic, Mary A.

2011 A Trail through Time: Hopland to Lakeport on an "Old Indian Trail". Master's thesis, Department of Anthropology, Sonoma State University, Rohnert Park, California.

Gibson, Erin

2007 The Archaeology of Movement in a Mediterranean Landscape. *Journal of Mediterranean Archaeology* 20(1):61-87.

Gould, Richard A.

1974 Some Current Problems in Ethnoarchaeology. In *Ethnoarchaeology*, edited by Christopher B. Donnan and C. William Clewlow, pp. 24-98. Monograph 4. Institute of Archaeology, University of California, Los Angeles, California.

- 1978 Beyond Analogy in Ethnoarchaeology. In *Explorations in Ethnoarchaeology*, edited by Richard A. Gould, pp. 249-293. 1st ed. Advanced Seminar Series, School of American Research. University of New Mexico Press, Albuquerque, New Mexico.
- 1980 Beyond Analogy. In *Living Archaeology*, pp. 29-47. New Studies in Archaeology. Cambridge University Press, Cambridge, England.
- Gould, Richard A. and Patty Jo Watson
 1982 A Dialogue on the Meaning and Use of Analogy in Ethnoarchaeological Reasoning. *Journal of Anthropological Archaeology* 1(4):355-381.
- Graf, David F.
 1994 The Persian Royal Road System. In *Continuity and change: Proceedings of the Last Achaemenid History Workshop, April 6-8, 1990, Ann Arbor, Michigan*, edited by Heleen Sancisi-Weerdenburg, Amélie Kuhrt and Margaret Cool Root, pp. 167-189. Nederlands Instituut voor het Nabije Oosten, Leiden, Netherlands.
- Gutiérrez González, Maritza
 1986 Interpretación preliminar de los rasgos «tumbas de botella» del sitio CENADA. In *Prehistoric Settlement Patterns in Costa Rica*, edited by Frederick W. Lange and Lynette C. Norr, pp. 255-268. Journal of the Steward Anthropological Society. Vol. 14. University of Illinois, Urbana, Illinois.
- Gutiérrez González, Maritza and Guiselle Mora Sierra
 1988 Reconocimiento y evaluación exploratoria de un complejo arquitectónico localizado entre llanuras: Cubujuquí. *Vínculos* 14:105-119.
- Gutiérrez Mendoza, Gerardo and Peter van Rossum
 2006 De los Valles Centrales de Oaxaca al Golfo de México. *Arqueología mexicana* XIV(81):32-36.
- Haberland, Wolfgang
 1961 *Archäologische Untersuchungen in der Provinz Chiriquí, Panamá*. Acta Humboldtiana. Series Geographica et Ethnographica, no. 3. Franz Steiner Verlag, Wiesbaden, Germany.
- 1984 The Valle de General and Panamanian Chiriquí: Temporal and Regional Differences. In *Inter-Regional Ties in Costa Rican Prehistory*, edited by Esther Skirboll and Winifred Creamer, pp. 261-276. BAR International Series. Vol. 226. British Archaeological Reports, Oxford, England.
- Habicht-Mauche, Judith, Michael Geselowitz and John W. Hoopes
 1987 Where's the Chief?: The Archaeology of Complex Tribes. Paper presented at the 52nd Annual Meeting of the Society for American Archaeology, Toronto, Canada.
- Hall, Thomas, P. Nick Kardulias and Christopher Chase-Dunn

- 2011 World-Systems Analysis and Archaeology: Continuing the Dialogue. *Journal of Archaeological Research* 19:233-279.
- Hare, Timothy S.
2004 Using measures of cost distance in the estimation of polity boundaries in the Postclassic Yautepec valley, Mexico. *Journal of Archaeological Science* 31(6):799-814.
- Hartman, Carl Vilhelm
1901 *Archæological Researches in Costa Rica*. Royal Ethnographical Museum, Stockholm, Sweden.
- Hassig, Ross
1991 Roads, Routes, and Ties that Bind. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 17-27. New Directions in Archaeology. Cambridge University Press, New York, New York.
- Heberling, Natalie L.
2010 Prehistoric Roads of New Mexico: A Synthesis of GIS and Remote Sensing Techniques. Master's thesis, Department of Geography, The University of New Mexico, Albuquerque, New Mexico.
- Heilen, Michael P.
2005 An Archaeological Theory of Landscapes, Department of Anthropology, The University of Arizona, Tucson, Arizona.
- Hobson, Archie
2001 *The Oxford Dictionary of Difficult Words*. Oxford University Press, New York, New York.
- Hoopes, John W.
1988 The Complex Tribe in Prehistory: Sociopolitical Organization in the Archaeological Record. Paper presented at the 53rd Annual Meeting of the Society for American Archaeology, Phoenix, Arizona.
- 1996 Settlement, Subsistence, and the Origins of Social Complexity in Greater Chiriquí: A Reappraisal of the Aguas Buenas Tradition. In *Paths to Central American Prehistory*, edited by Frederick W. Lange, pp. 15-48. University Press of Colorado, Niwot, Colorado.
- 2001 Race, Language, and Culture in the Intermediate Area: Recovering Chibchan Identities from the Mid-Hemispheric "Periphery". *Proceedings of the 100th Annual Meeting of the American Anthropological Association, November 28 - December 2, 2001*. Washington, D.C.

- 2005 The Emergence of Social Complexity in the Chibchan World of Southern Central America and Northern Colombia, AD 300-600. *Journal of Archaeological Research* 13(1):1-47.
- 2008 Establishing Cultural Contexts for Mobility and Exchange Among Populations of the Antilles and the Isthmo-Colombian Area. Paper presented at the symposium "Mobility and Exchange from a Pan-Caribbean Perspective," 73rd Annual Meeting of the Society for American Archaeology, Vancouver, British Columbia.
- Hoopes, John W. and Oscar Manuel Fonseca Zamora
 2003 Goldwork and Chibchan Identity: Endogenous Change and Diffuse Unity in the Isthmo-Colombian Area. In *Gold and Power in Ancient Costa Rica, Panama, and Colombia: A Symposium at Dumbarton Oaks, 9 and 10 October 1999*, edited by Jeffrey Quilter and John W. Hoopes, pp. 49-90. Dumbarton Oaks Research Library and Collections, Washington, D.C.
- Hoopes, John W., Silvia Salgado González and Mario Arias
 2009 Segundo informe parcial: Proyecto "Contribuciones a la Arqueología de Suerre". Manuscript on file, Archivo de Investigación, Departamento de Antropología e Historia, Museo Nacional de Costa Rica, San José, Costa Rica.
- Howey, Meghan C. L.
 2007 Using multi-criteria cost surface analysis to explore past regional landscapes: a case study of ritual activity and social interaction in Michigan, AD 1200-1600. *Journal of Archaeological Science* 34(11):1830-1846.
- 2011 Multiple pathways across past landscapes: circuit theory as a complementary geospatial method to least cost path for modeling past movement. *Journal of Archaeological Science* 38(10):2523-2535.
- Hyslop, John
 1984 *The Inka Road System*. Studies in Archaeology. Academic Press, Orlando, Florida.
- 1991 Observations About Research on Pre-Historic Roads in South America. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 28-33. New Directions in Archaeology. Cambridge University Press, New York, New York.
- Ibarra Rojas, Eugenia
 2002 *Las sociedades cacicales de Costa Rica (Siglo XVI)*. 2nd ed. Colección historia de Costa Rica 3. Editorial Universidad de Costa Rica, San José, Costa Rica.
- Imhof, Eduard
 1950 *Gelände und Karte*. Rentsch, Erlenbach-Zürich, Germany.

- Instituto Geográfico Nacional de Costa Rica (IGNCR)
1967 *Carrillo*. Hoja Cartigrafica, 3446 III, 1:50,000. Instituto Geografico Nacional, San José, Costa Rica.
- Isaac, Benjamin H. and Israel Roll
1982 *Roman Roads in Judea I: The Legio-Scythopolis Road*. BAR International Series 141. British Archaeological Reports, Oxford, England.
- Jansen, Anton G.
1994 Stations Along the Roads in the Area of Mycenae: An Analysis of the Mycenaean Road System and its Relation to the Mycenaean State. Ph.D. Dissertation, Department of Classical Studies, University of Pennsylvania, Philadelphia, Pennsylvania.

2002 *A Study of the Remains of Mycenaean Roads and Stations of Bronze-Age Greece*. Mellen Studies in Archaeology 1. The Edward Mellen Press, Lewiston, New York.
- Jarvis, Andrew, Hannes Isaak Reuter, Andy Nelson and Edward Guevara
2008 Hole-filled seamless SRTM data for the globe Version 4.1. International Centre for Tropical Agriculture (CIAT) Consortium for Spatial Information. Electronic resource, <http://srtm.csi.cgiar.org>, accessed October 28, 2011.
- Johnston, David E.
1979 *An Illustrated History of Roman Roads in Britain*. Spurbooks, Bourne End, England.
- Jones, Ursula
1992 Decorated Metates in Prehispanic Lower Central America. Ph.D. dissertation, Institute of Archaeology, University College, London.
- Kahane, Anne, Leslie M. Threipland and John B. Ward-Perkins
1968 The Ager Veientanus, North and East of Rome. *Papers of the British School in Rome* 36:1-218.
- Kantner, John
1997 Ancient Roads, Modern Mapping: Evaluating Chaco Anasazi Roadways Using GIS Technology. *Expedition* 39(3):49-61.

2004 Geographical Approaches for Reconstructing Past Human Behavior from Prehistoric Roadways. In *Spatially Integrated Social Science*, edited by Michael F. Goodchild and Donald G. Janelle, pp. 323-344. Spatial Information Systems. Oxford University Press, New York, New York.
- Kardulias, P. Nick
1999 *World-Systems Theory in Practice: Leadership, Production, and Exchange*. *Papers presented at the 94th annual meeting of the American Anthropological*

Association in Washington, D.C., November, 1995. Rowman & Littlefield Publishers, Lanham, Maryland.

Kardulias, P. Nick and Thomas D. Hall

2008 Archaeology and World-Systems Analysis. *World Archaeology* 40(4):572 - 583.

Keller, Angela H.

2009 A Road by Any Other Name: Trails, Paths, and Roads in Maya Language and Thought. In *Landscapes of Movement: Trails, Paths, and Roads in Anthropological Perspective*, edited by James E. Snead, Clark L. Erickson and J. Andrew Darling, pp. 133-157. 1st ed. Penn Museum International Research Conference,, Holly Pittman, general editor. University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, Pennsylvania.

Kendall, Ann

2000 Una red de caminos prehispánicos: Rutas de comercio en el distrito de Ollantaytambo, Cuzco, Perú. In *Caminos precolombinos: las vías, los ingenieros y los viajeros*, edited by Marianne Cardale de Schrimpf and Leonor Herrera, pp. 221-241. Instituto Colombiano de Antropología e Historia: Ministerio de Cultura, Bogotá, Colombia.

Kennedy, William Jerald

1968 Archaeological Investigation in the Reventazón River Drainage Area. Ph.D. dissertation, Department of Anthropology, Tulane University, New Orleans, Louisiana.

1976 Prehistory of the Reventazón River drainage area, Costa Rica. *Vínculos* 2(1):87–100.

Kohl, Philip L.

1987 The Use and Abuse of World Systems Theory: The Case of the Pristine West Asian State. *Advances in Archaeological Method and Theory* 11:1-35.

Kosok, Paul

1954 Transport in Peru. In *Proceedings of the Thirtieth International Congress of Americanists, held at Cambridge, 18-23 August 1952*, edited by International Congress of Americanists and Royal Anthropological Institute of Great Britain and Ireland, pp. 65-71. The Royal Anthropological Institute, London, England.

Lange, Frederick W.

1984 Cultural Geography of Pre-Columbian Lower Central America. In *The Archaeology of Lower Central America*, edited by Frederick W. Lange and Doris Z. Stone, pp. 33-60. School of American Research and University of New Mexico Press, Albuquerque, New Mexico.

Laurence, Ray

- 1999 *The Roads of Roman Italy: Mobility and Cultural Change*. Routledge, London, England.
- Lines, Jorge A.
1938 *Notes on the archaeology of Costa Rica*. 2nd ed. The National Tourist Board of Costa Rica, San José, Costa Rica.
- Lippi, Ronald D.
2000 Caminos antiguos en el Pichincha Occidental (Ecuador). In *Caminos precolombinos: las vías, los ingenieros y los viajeros*, edited by Marianne Cardale de Schrimpf and Leonor Herrera, pp. 117-135. Instituto Colombiano de Antropología e Historia: Ministerio de Cultura, Bogotá, Colombia.
- Llobera, Marcos, P. Fabrega-Alvarez and C. Parceró-Oubina
2011 Order in movement: a GIS approach to accessibility. *Journal of Archaeological Science* 38(4):843-851.
- Lothrop, Samuel K.
1961 Peruvian Stylistic Impact on Lower Central America. In *Essays in Precolumbian Art and Archaeology*. Harvard University Press, Cambridge, Massachusetts.
- Lyell, Charles
1837 *Principles of Geology: Being an Inquiry How Far the Former Changes of the Earth's Surface are Referable to Causes Now in Operation*. 1st American from the 5th and last London ed. J.I. Kay & co., Philadelphia, Pennsylvania.
- Lyman, R. Lee and Michael J. O'Brien
2001 The Direct Historical Approach, Analogical Reasoning, and Theory in Americanist Archaeology. *Journal of Archaeological Method and Theory* 8(4):303-342.
- Madry, Scott and Carole Crumley
1990 An Application of Remote Sensing and GIS in a Regional Archaeological Survey. In *Interpreting Space: GIS and Archaeology*, edited by Kathleen M. S. Allen, Stanton W. Green and Ezra B. W. Zubrow, pp. 364-381. Applications of Geographic Information Systems. Taylor & Francis, New York, New York.
- Margary, Ivan Donald
1955 *Roman Roads in Britain*. Phoenix House, London, England.
- Mathien, Frances Joan
1991 Political, Economic, and Demographic Implications of Chaco Road Network. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 99-110. New Directions in Archaeology. Cambridge University Press, New York, New York.
- McGovern, William Montgomery

- 1927 *Jungle Paths and Inca Ruins*. The Century Co., New York, New York.
- McKee, Brian R. and Thomas L. Sever
1994 Remote Sensing in the Arenal Region. In *Archaeology, Volcanism, and Remote Sensing in the Arenal Region, Costa Rica*, edited by Payson D. Sheets and B. McKee, pp. 135-141. University of Texas Press, Austin, Texas.
- McKee, Brian R., Thomas L. Sever and Payson D. Sheets
1994 Prehistoric Footpaths in Costa Rica: Remote Sensing and Field Verification. In *Archaeology, Volcanism, and Remote Sensing in the Arenal Region, Costa Rica*, edited by Payson D. Sheets and Brian R. McKee, pp. 142-157. University of Texas Press, Austin, Texas.
- McKillop, Heather
2010 Ancient Maya Canoe Navigation and Its Implications for Classic to Postclassic Maya Economy and Sea Trade: A View from the South Coast of Belize. *Journal of Caribbean Archaeology* Special Publication #3:93-105.
- Menard, Jason Christopher
2011 Using GIS and Historical Data to Reconstruct the Ravenglass-Ambleside Roman Road, Cumbria, United Kingdom. Unpublished Ph.D. dissertation, Department of Anthropology, University of Minnesota, Minneapolis, Minnesota.
- Ministry of Economy Trade and Industry of Japan (METI) and United States National Aeronautics and Space Administration (NASA)
2011 Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model (GDEM) V002. ECS Land Processes Distributed Active Archive Center. Electronic resource, <http://reverb.echo.nasa.gov/reverb/>, accessed February 2, 2012.
- Mock, Shirley Boteler
1997 Monkey Business at Northern River Lagoon: A Coastal-Inland Interaction Sphere in Northern Belize. *Ancient Mesoamerica* 8(02):165-183.
- Molina Montes de Oca, Carlos
2005 *Y las mulas no durmieron... Los arrieros en Costa Rica. Siglos XVI al XIX*. Editorial Universidad Estatal a Distancia, San José, Costa Rica.
- Mora-Marín, David F.
2005 The Jade-to-gold Shift in Ancient Costa Rica: A World Systems Perspective. Manuscript on file, UNC-Chapel Hill, North Carolina.
- Munson, Patrick J.
1969 Comments on Binford's "Smudge Pits and Hide Smoking: The Use of Analogy in Archaeological Reasoning". *American Antiquity* 34(1):83-85.

Murillo Herrera, Mauricio

2002 Análisis crítico de las investigaciones arqueológicas desarrolladas en el Sitio Guayabo (UCR-43), de Turrialba y las repercusiones sociales con relación al manejo de sus recursos culturales. Unpublished Licentiate's thesis, Escuela de Antropología y Sociología, Univesidad de Costa Rica, Ciudad Universitaria Rodrigo Facio, San José, Costa Rica.

Navarrete, Agustín

1899 Las necrópolis de San Juan. In *Informe del segundo semestre y fin de año económico 1898 a 1899*, edited by Juan Fernández Ferraz, pp. 29-51. Museo Nacional de Costa Rica. Tipología Nacional, San José, Costa Rica.

Normark, Johan

2008 The Triadic Causeways of Ichmul: Virtual Highways Becoming Actual Roads. *Cambridge Archaeological Journal* 18(02):215-238.

Norweb, Albert Holden

1961 The Archaeology of the Greater Nicoya Subarea. Manuscript on file, Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge, Massachusetts.

1964 Ceramic Stratigraphy in Southwestern Nicaragua. In *Actas y memorias: Proceedings of the 35th International Congress of Americanists, Mexico City, Mexico, 1962*, pp. 551-561. Vol. 1.

Novoa Espinoza, Virginia

1999 Denuncia de huaquerismo en horquetas de Sarapiquí: Finca Santa Clara. Manuscript on file, Archivo de Investigación, Departamento de Antropología e Historia, Museo Nacional de Costa Rica, San José, Costa Rica.

Núñez, Johnny

1995 La ruta a Carrillo. *La Nación* August 27:16-17. San José, Costa Rica.

Obenauf, Margaret S.

1991 Photointerpretation of Chacoan roads. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 34-41. New Direction in Archaeology. Cambridge University Press, New York, New York.

Orser, Charles E., Jr.

2009 World-Systems Theory, Networks, and Modern-World Archaeology. In *International Handbook of Historical Archaeology*, edited by Teresita Majewski and David Gaimster, pp. 253-268. Springer Science+Business Media, LLC, New York, New York.

Peraldo Huertas, Giovanni and Ernesto Rojas Cedeño

1998 La deslizable histoia del ferrocarril al Caribe de Costa Rica. *Anuario de Estudios Centroamericanos* 24(2):97-128.

- Peralta, Manuel M. de and Anastasio Alfaro González
 1893 *Entología centro-americana; catálogo razonado de los objetos arqueológicos de la República de Costa-Rica en la Exposición histórico-americana de Madrid--1892*. Impreso por los hijos de M. Ginés Hernández para la legación de Costa Rica en Madrid y Paris, Madrid, Spain.
- Peregrine, P. N.
 1996 Archaeology and World-Systems Theory. *Sociological Inquiry* 66(4):486-495.
- Peregrine, Peter N. and Gary M. Feinman
 1996 *Pre-Columbian World Systems*. Monographs in World Archaeology. Prehistory Press, Madison, Wisconsin.
- Peytrequín Gómez, Jeffrey
 2007 Hallazgo de cerámica plomiza en el sitio Agua Caliente, Valle Central Oriental de Costa Rica. *Vínculos* 30(1-2):155-158.
- 2009 Agua Caliente, espacialidad y arquitectura en una comunidad nucleada antigua de Costa Rica. *Cuadernos de Antropología* 19:31-55.
- Peytrequín Gómez, Jeffrey and Mónica Aguilar Bonilla
 2007a Agua Caliente (C-35AC): Arquitectura, procesos de trabajo e indicadores arqueológicos de un modo de vida cacical en una aldea nucleada en el Intermontano Central, Costa Rica. Unpublished Licentiate's thesis, Escuela de Antropología y Sociología, Universidad de Costa Rica, Ciudad Universitaria Rodrigo Facio, San José, Costa Rica.
- 2007b Los indicadores arqueológicos de un modo de vida cacical en el sitio Agua Caliente. *Vínculos* 30(1-2):57-81.
- Polakowsky, H.
 1888 *Boletín del Instituto Geográfico Nacional* 1-2. Tipografía Nacional, San José, Costa Rica.
- 1890 Antigüedades de Costa Rica. In *Anales del Instituto Físico-Geográfico y del Museo Nacional de Costa Rica*. Vol. 3, San José.
- Quintanilla Jiménez, Ifigenia
 1992 La Malla: un sitio arqueológico asociado al uso de recursos del Manglar de Tivives, Pacífico Central de Costa Rica. *Vínculos* 16 (1990)(1-2):57-83.
- Rodríguez Ramos, Reniel
 2010 What is the Caribbean? An Archaeological Perspective. *Journal of Caribbean Archaeology* Special Publication #3:19-51.

- Rodríguez Ramos, Reniel and Jaime Pagán Jiménez
2006 Interacciones Multivectoriales en el Circum-Caribe Precolonial: Un Vistazo desde las Antillas. *Caribbean Studies* 34(2):99-139.
- Rothe, Fernando
1927 *Plano de las regiones de la Patria, Colonia Salvador, Santa Clara, Vara Blanca y Sarapiquí*. Plano 1:80,000, 61 x 77 cm map reduced to 1:200,000. United Fruit Company, San José, Costa Rica.
- Sakaguchi, Takashi, Jesse Morin and Ryan Dickie
2010 Defensibility of large prehistoric sites in the Mid-Fraser region on the Canadian Plateau. *Journal of Archaeological Science* 37(6):1171-1185.
- Sánchez, J. C.
2005 La vía arqueológica de Monteverde: un sendero en el bosque primario. Paper presented at the Mesa de Discusión Guanacaste: descubrimientos más recientes. IV Congreso Costarricense de Antropología, 6-8 December 2005, San José, Costa Rica.
- Sánchez Pereira, Maureen
1987 Un estudio de la arqueología de la Cuenca Superior y Media del Río Reventazón. Unpublished Licentiate's thesis, Escuela de Antropología y Sociología, Universidad de Costa Rica, Ciudad Universitaria Rodrigo Facio, San José, Costa Rica.
- Santley, Robert S.
1991 The Structure of the Aztec Transport Network. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 198-210. New Directions in Archaeology. Cambridge University Press, New York, New York.
- Schiffer, Michael B.
1987 *Formation Processes of the Archaeological Record*. 1st ed. University of New Mexico Press, Albuquerque, New Mexico.
- Schneider, Jane
1991 Was There a Precapitalist World-System? In *Core/Periphery Relations in the Precapitalist World*, edited by Christopher K. Chase-Dunn and Thomas D. Hall, pp. 45-66. Westview Press, Boulder, Colorado.
- Schreiber, Katharina Jeanne
1991 The Association Between Roads and Politics: Evidence for Wari Roads in Peru. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 243-252. New Directions in Archaeology. Cambridge University Press, New York, New York.
- Schwake, Sonja Andrea

- 2000 On the Road: Excavations along the Maya Sacbe at X-uul-canal, Cayo District, Belize. Master's thesis, Department of Anthropology, Trent University, Peterborough, Ontario.
- Sever, Thomas L.
1990 Remote Sensing Applications in Archaeological Research: Tracing Prehistoric Human Impact on the Environment. Ph.D., Department of Anthropology, University of Colorado, Boulder, Colorado.
- Sever, Thomas L. and Payson D. Sheets
2007 Creating and Perpetuating Social Memory Across the Ancient Costa Rica Landscape. In *Remote Sensing in Archaeology*, edited by James Wiseman and Farouk El-Baz, pp. 161-184. Interdisciplinary Contributions To Archaeology. Springer, New York, New York.
- Sever, Thomas L., Payson D. Sheets and Daniel E. Irwin
2003 Satellite and Airborne Remote Sensing Analysis for the Detection of Ancient Footpaths in Costa Rica. *Vínculos* 28:9-18.
- Sever, Thomas L. and David W. Wagner
1991 Analysis of Prehistoric Roadways in Chaco Canyon Using Remotely Sensed Digital Data. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 42-52. New Directions in Archaeology. Cambridge University Press, New York, New York.
- Shaw, Justine M.
2001 Maya Sacbeob: Form and Function. *Ancient Mesoamerica* 12(2):261-272.

2008 *White Roads of the Yucatán: Changing Social Landscapes of the Yucatec Maya*. University of Arizona Press, Tucson, Arizona.
- Sheets, Payson
2009 When the Construction of Meaning Preceded the Meaning of Construction: From Footpaths to Monumental Entrances in Ancient Costa Rica. In *Landscapes of Movement: Trails, Paths, and Roads in Anthropological Perspective*, edited by James E. Snead, Clark L. Erickson and J. Andrew Darling, pp. 158-179. 1st ed. Penn Museum International Research Conference, Holly Pittman, general editor. University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, Pennsylvania.
- Sheets, Payson D.
1994 Percepción remota y exploraciones geofísicas aplicadas a la arqueología en áreas volcánicas activas de Costa Rica y El Salvador. *Vínculos* 18(1-2):31-54.
- Sheets, Payson D. and Brian R. McKee
1994 *Archaeology, Volcanism, and Remote Sensing in the Arenal Region, Costa Rica*. 1st ed. University of Texas Press, Austin, Texas.

Sheets, Payson D. and Thomas L. Sever

1991 Prehistoric Footpaths in Costa Rica: Transportation and Communication in a Tropical Rainforest. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 53–65. New Directions in Archaeology. Cambridge University Press, New York, New York.

Sherman, R. Jason, Andrew K. Balkansky, Charles S. Spencer and Brian D. Nicholls

2010 Expansionary dynamics of the nascent Monte Albán state. *Journal of Anthropological Archaeology* 29(3):278-301.

Sitwell, Nigel H. H.

1981 *Roman Roads of Europe*. Cassell, London, England.

Skinner, Alanson

1926 Notes on Las Mercedes, Costa Rica Farm, and Anita Grande. In *Pottery of Costa Rica and Nicaragua*, edited by Samuel Kirkland Lothrop, pp. 451-467. Contributions. Vol. 2. Museum of the American Indian, Heye Foundation, New York, New York.

Smith, M. A.

1955 The Limitations of Inference in Archaeology. *The Archaeological Newsletter* 6:1-7.

Snarskis, Michael J.

1975 Excavaciones estratigráficas en la Vertiente Atlántica de Costa Rica. *Vínculos* 1(1):2-17.

1976a La Vertiente Atlántica de Costa Rica. *Vínculos* 3(1):101-114.

1976b Stratigraphic Excavations in the Eastern Lowlands of Costa Rica. *American Antiquity* 41(3):342-353.

1978 The Archaeology of the Central Atlantic Watershed of Costa Rica. Unpublished Ph.D. dissertation, Department of Anthropology, Columbia University, New York, New York.

1984 Prehistoric Microsettlement Patterns in Eastern and Central Costa Rica. In *Recent Developments in Isthmian Archaeology*, edited by Frederick W. Lange, pp. 153-177. BAR International Series. Vol. 212, Oxford, Great Britain.

1998 Stone Sculpture and Pre-Columbian Cultural Evolution in the Central Highlands-Atlantic Watershed of Costa Rica/La sculpture en pierre et l'évolution culturelle précolombienne sur l'Altiplano Central et sur le versant atlantique du Costa Rica. *Precolombart* 1:19-41.

- 2003 From Jade to Gold in Costa Rica: How, Why, and When. In *Gold and Power in Ancient Costa Rica, Panama, and Colombia*, edited by Jeffrey Quilter and John W. Hoopes, pp. 159-204. Dumbarton Oaks, Washington, D.C.
- Snead, James E., Clark L. Erickson and J. Andrew Darling
 2009a Landscapes of Movement: Trails, Paths, and Roads in Anthropological Perspective. *Proceedings of the Penn Museum International Research Conference*, . Philadelphia, Pennsylvania.
- 2009b Making Human Space: The Archaeology of Trails, Paths, and Roads. In *Landscapes of Movement: Trails, Paths, and Roads in Anthropological Perspective*, edited by James E. Snead, Clark L. Erickson and J. Andrew Darling, pp. 1-19. 1st ed. Penn Museum International Research Conference,, Holly Pittman, general editor. University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, Pennsylvania.
- Sofaer, Anna, Michael P. Marshall and Rolf M. Sinclair
 1989 The Great North Road: a Cosmographic Expression of the Chaco culture of New Mexico. In *World Archaeoastronomy: selected papers from the 2nd Oxford International Conference on Archaeoastronomy, held at Merida, Yucatan, Mexico, 13-17 January 1986*, edited by Anthony F. Aveni, pp. 365-376. Cambridge University Press, Cambridge, England.
- Solís Alpizar, Olman
 1992 Jesús María: un sitio con actividad doméstica en el Pacífico Central, Costa Rica. *Vínculos* 16 (1990)(1-2):31-56.
- Solís Alpizar, Olman, Ana Elena Pérez and Luis Felipe Solís Del Vecchio
 1988 Prospección a los alrededores del sitio Agua Caliente, Cartago (C-35AC): metodología y resultados iniciales. *Cuadernos de Antropología* 7:52-105.
- Solís del Vecchio, Felipe and Anayensy Herrera Villalobos
 1992 Lomas Entierros: un centro político prehispánico en La Cuenca Baja del Río Grande de Tárcos. *Vínculos* 16 (1990)(1-2):85-110.
- Solorzano Fonseca, Juan Carlos
 1988 *Medios de comunicacion y transporte en Costa Rica durante la Epoca Colonial*. Universidad de Costa Rica Centro de Invesitgaciones Historicas, San José, Costa Rica.
- Staccioli, Romolo Augusto
 2003 *The Roads of the Romans*. J. Paul Getty Museum, Los Angeles, California.
- Stanish, C., E. de la Vega, M. Moseley, P. R. Williams, C. J. Cecilia, B. Vining and K. LaFavre
 2010 Tiwanaku trade patterns in southern Peru. *Journal of Anthropological Archaeology* 29(4):524-532.

Stanton, Travis W.

2005 Formative Maya Causeways: Incipient Internal Site Design at Yaxuná, Yucatán, Mexico. *Mono y Conejo: Journal of the Mesoamerican Archaeological Research Lab, The University of Texas at Austin* 3:32-34.

Stein, Gil J.

1999a *Rethinking World-Systems: Diasporas, Colonies, and Interaction in Uruk Mesopotamia*. University of Arizona Press, Tucson, Arizona.

1999b Rethinking World-Systems: Power, Distance, and Diasporas in the Dynamics of Interregional Interaction. In *World-Systems Theory in Practice: Leadership, Production, and Exchange*, edited by P. Nick Kardulias, pp. 153-178. Rowman & Littlefield Publishers, Lanham, Maryland.

Steward, Julian H.

1942 The Direct Historical Approach to Archaeology. *American Antiquity* 7(4):337-343.

1963 The Circum-Caribbean Tribes: An Introduction. In *Handbook of South American Indians*, edited by Julian H. Steward. Vol. 2. Cooper Square Publishers, Inc, New York, New York.

Stewart, Watt

1964 *Keith and Costa Rica: A Biographical Study of Minor Cooper Keith*. University of New Mexico Press, Albuquerque, New Mexico.

Stirling, Matthew Williams

1969 Archaeological Investigations in Costa Rica. *National Geographic Society Research Reports, 1964 Projects*:239-247.

Stirling, Matthew Williams and Marion Stirling Pugh

1997 *Investigaciones arqueológicas en Costa Rica*. 1 ed. Translated by Geovanna Sánchez and Ricardo Vázquez Leiva. Museo Nacional de Costa Rica, San José, Costa Rica.

Stone, Doris Zemurly

1966 *Introduction to the Archaeology of Costa Rica*. Revised ed. Museo Nacional de Costa Rica, San José, Costa Rica.

1977 *Pre-Columbian Man in Costa Rica*. Peabody Museum Press, Cambridge, Massachusetts.

Strong, William Duncan

1972 From History to Prehistory in the Northern Great Plains. *The Plains Anthropologist* 17(57):353-394.

Taliaferro, M. S., B. A. Schriever and M. S. Shackley

2010 Obsidian procurement, least cost path analysis, and social interaction in the Mimbres area of southwestern New Mexico. *Journal of Archaeological Science* 37(3):536-548.

Tobler, Waldo R.

1993 *Three Presentations on Geographical Analysis and Modeling: 1) Non-Isotropic Geographic Modeling; 2) Speculations on the Geometry of Geography; and 3) Global Spatial Analysis*. National Center for Geographic Information Analysis (NCGIA), University of California, Santa Barbara, California.

Tristán, José Fidel

1922 Notas arqueológicas de La Sabana. *Revista de Costa Rica* 5(5-6):153-156.

1924 A peculiar idol from the highlands of Costa Rica. *American Journal of Archaeology Ser. 2* 28(3):293-295.

1925 Zoología americana indígena. *Revista de Costa Rica* 6(9):192-194.

2007 *Diario de Arqueología de José Fidel Tristán*. 1 ed. Museo Nacional de Costa Rica, San José, Costa Rica.

Trombold, Charles D.

1991a *Ancient Road Networks and Settlement Hierarchies in the New World*. New Directions in Archaeology. Cambridge University Press, New York, New York.

1991b An Introduction to the Study of Ancient New World Road Networks. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 1-9. New Directions in Archaeology. Cambridge University Press, New York, New York.

Troyo Vargas, Elena (editor) 2002 *Guayabo de Turrialba: una aldea prehispánica compleja*. Ministerio de Cultura, Juventud y Deportes, Centro de Investigación y Conservación de Patrimonio Cultural, San José, Costa Rica.

Troyo Vargas, Elena and José Enrique Garnier Zamora

2002 Acciones para la preservación del sitio Guayabo: consolidación y restauración. In *Guayabo de Turrialba: una aldea prehispánica compleja*, edited by Elena Troyo Vargas, pp. 71-135. Ministerio de Cultura, Juventud y Deportes, Centro de Investigación y Conservación de Patrimonio Cultural, San José, Costa Rica.

Troyo Vargas, Elena and Juan Vicente Guerrero Miranda

1998 Las vías de comunicación en la Costa Rica prehispánica. *Patrimonio* 3:81-90.

Valerio Lobo, Wilson

- 1989 Patrones de asentamiento en Agua Caliente de Cartago, Costa Rica. *Vínculos* 15:25-44.
- Valerio Lobo, Wilson, Oltman Solís Alpizar and Felipe Solís Del Vecchio
 1986 Agua Caliente de Cartago: Del rescate súbito a la investigación a largo plazo. *Vínculos* 12(1-2):39-50.
- van Leusen, Martijn
 2002 Pattern to Process: Methodological Investigations into the Formation and Interpretation of Spatial Patterns in Archaeological Landscapes, Groningen Institute of Archaeology, University of Groningen, Groningen, Netherlands.
- Vanhove, Doris, A. de Wulf, Paul de Paepe and Luc Moens
 1996 *Roman Marble Quarries in Southern Euboea and the Associated Road Systems*. E.J. Brill, Leiden, Netherlands.
- Vázquez de Coronado, Juan
 1964 *Cartas de relación sobre la conquista de Costa Rica*. 2nd ed. Academia de Geografía e Historia de Costa Rica, San José, Costa Rica.
- Vázquez Leiva, Ricardo
 1989 Representaciones demográficas y estructurales de la organización social en las prácticas funerarias del sitio Agua Caliente, Cartago, Costa Rica. *Vínculos* 15: 1-23.
- 2002 *Arqueología del área de influencia del Proyecto Hidroeléctrico Angostura, Valle de Turrialba*. Copicentro por ICE y MNCR, San José, Costa Rica.
- 2006a Levantamiento planimétrico del sitio Las Flores (L-143 LF): complejo arquitectónico en el interfluvio de los ríos Corinto y Costa Rica, Caribe Central. Manuscript on file, Archivo de Investigación, Departamento de Antropología e Historia, Museo Nacional de Costa Rica, San José, Costa Rica.
- 2006b Planimetrías de varios sitios arqueológicos con arquitectura y obras viales de la zona de Línea Vieja, Caribe Central de Costa Rica. Manuscript on file, Archivo de Investigación, Departamento de Antropología e Historia, Museo Nacional de Costa Rica, San José, Costa Rica.
- Vázquez Leiva, Ricardo and Claude Chapdelaine
 2008 Arquitectura, Caminos Empedrados y Cronología del Sector Principal del Sitio Las Mercedes-1, Caribe Central de Costa Rica. *Vínculos* 31:27-77.
- Vázquez Leiva, Ricardo, Juan Vicente Guerrero Miranda and Julio César Sánchez Herrera
 2003 Cutris: Descripción, cronología y afiliación de un centro arquitectónico con caminos monumnetales en la Llanura de San Carlos, Costa Rica. *Vínculos* 28:149-174.
- Vázquez Leiva, Ricardo, Harry Massey Ramírez and Julio César Sánchez Herrera

- 2002 Guayabo y su relación con el Valle de Turrialba en el período VI (1000-450 a.p.): Prospección de las calzadas Caragra y Alto Varas. In *Arqueología del área de influencia del Proyecto Hidroeléctrico Angostura, Valle de Turrialba*, edited by Ricardo Vázquez Leiva, pp. 315-333. Copicentro por ICE y MNCR, San José, Costa Rica.
- Villa Rojas, Alfonso
1934 *The Yaxuna-Cobá Causeway*. Contributions to American Archaeology 2(9), Carnegie Institution of Washington Publication 436. Carnegie Institution of Washington, Washington, D.C.
- Wallerstein, Immanuel
1974 *The Modern World-System: Capitalist Agriculture and the Origins of the European World-Economy in the Sixteenth Century*. Academic Press, New York, New York.
- Watson, Patty Jo
1980 The Theory and Practice of Ethnoarcheology with special reference to the Near East. *Paléorient*:55-64.
- Watson, Patty Jo, Steven A. LeBlanc and Charles L. Redman
1971 *Explanation in Archeology: An Explicitly Scientific Approach*. Columbia University Press, New York, New York.
- Wedel, Waldo Rudolph
1938 The Direct-Historical Approach in Pawnee Archeology. *Smithsonian Miscellaneous Collections* 97(7):1-21.
- Wheeler, Ryan J., James J. Miller, Ray M. McGee, Donna Ruhl, Brenda Swann and Melissa Memory
2003 Archaic Period Canoes from Newnans Lake, Florida. *American Antiquity* 68(3):533-551.
- Whitley, Thomas G. and Lacey M. Hicks
2003 A Geographic Information Systems Approach to Understanding Potential Prehistoric and Historic Travel Corridors. *Southeastern Archaeology* 22(1):77-91.
- Wiedemann, Torsten, Mark Antrop and Frank Vermeulen
2001 Analysis of the Roman Road System around Cassel and Application of a GIS-Model in Sandy Flanders. In *Ancient Lines in the Landscape: A Geo-archaeological Study of Protohistoric and Roman Roads and Field Systems in Northwestern Gaul*, edited by Frank Vermeulen and Mark Antrop, pp. 83-96. Bulletin antieke beshaving, supplement. Peeters, Leuven, Belgium.
- Wilkinson, T. J.

- 2009 The Archaeology of Landscape. In *A Companion to Archaeology*, edited by John L. Bintliff, pp. 334-356. Blackwell Companion to Archaeology. Blackwell, Malden, Massachusetts.
- Willey, Gordon R
 1959 The "Intermediate Area" of Nuclear America: Its Prehistoric Relationships to Middle America and Peru. In *Actas del XXXIII Congreso Internacional de Americanistas*, pp. 184-194. Vol. 1, San José, Costa Rica.
- Willey, Gordon R. and Phillip Phillips
 1958 *Method and Theory in American Archaeology*. University of Chicago Press, Chicago, Illinois.
- Windes, Thomas C.
 1991 The Prehistoric Road Network at Pueblo Alto, Chaco Canyon, New Mexico. In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by Charles D. Trombold, pp. 111-131. New Directions in Archaeology. Cambridge University Press, New York, New York.
- Wylie, Alison
 1982 An Analogy by Any Other Name is Just as Analogical a Commentary on the Gould-Watson Dialogue. *Journal of Anthropological Archaeology* 1(4):382-401.
- 1985 The Reaction Against Analogy. *Advances in Archaeological Method and Theory* 8:63-111.
- 1988 "Simple" Analogy and the Role of Relevance Assumptions: Implications of Archaeological Practice. *International Studies in the Philosophy of Science* 2(2):134-150.
- Zavaleta, José Antonio
 1957 La Carreta a Carrillo. *Revista de Agricultura* 29(2):56-58.
- Zuidema, Reiner Tom
 1964 *The Ceque System of Cuzco: The Social Organization of the Capital of the Inca*. Translated by Eva M. Hooykaas. International Archives of Ethnography 50 Supplement. E.J. Brill, Leiden, Netherlands.